

Nature Magazine

JUNE-JULY
1956

VOLUME 49
NUMBER 6
50 Cents

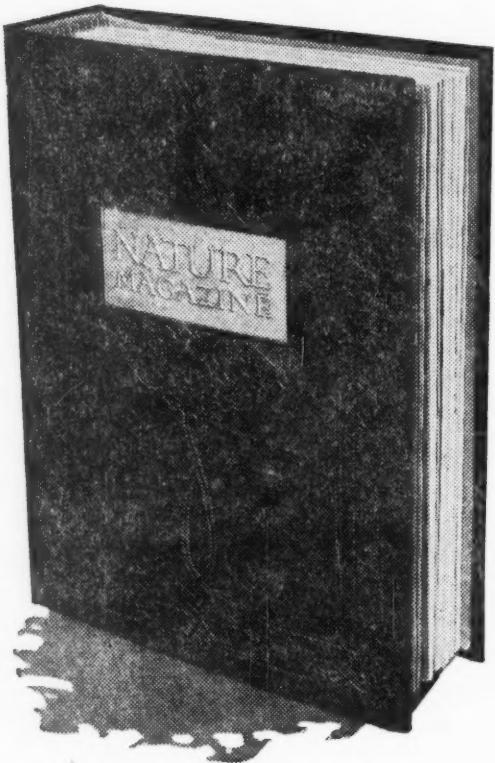


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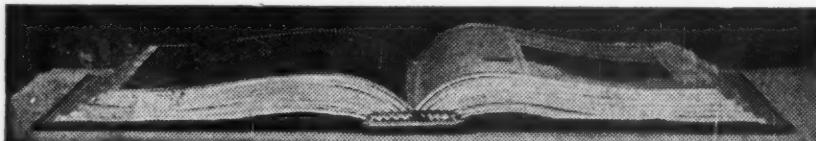
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Reviews

Elements of Ecology

By George L. Clarke. New York. 1954. John Wiley and Sons. 534 pages. Illustrated.

It took a surprising long time for man to realize fully that, as the author of this important textbook says: "Every plant and animal is subject to both the living and the non-living influences of its surroundings. Every organism depends upon its environment to supply it with vital materials and energy. Every living being must share its world with members of its own species and with members of other species—be they friend or foe."

Dr. Clarke, who is Associate Professor of Zoology at Harvard University, points out that man is no exception. "Man is surrounded by many kinds of living things, and he must derive his needs from the world around him. Man must learn to live in adjustment with his fellow men, and with the plants and animals of his environment, and to use his natural resources judiciously, or he will be exterminated."

Taking his text from these established facts, and from the vital importance of these crucial interrelationships—with, therefore, ecology—the author brings together the elements of ecology, specially emphasizing the modern viewpoint with respect to this science. He writes primarily for students of the subject, but his text is clear, direct and interesting. Indeed, this textbook is far less textbookish than the majority, and therefore certainly of value to anyone wishing to inform himself on such a basic subject as ecology.

R.W.W.

Gem Cutting

By John Sinkankas. New York. 1955. D. Van Nostrand Company. 413 pages. Illustrated. \$8.95.

The cult—if we may call it such—of the rockhound and the amateur worker with gem stones continues to grow. A few months ago we attended a national show of rock and gem enthusiasts in Washington, D.C., and were amazed at the extent and fascination of this hobby. We therefore found this immediate volume specially interesting, for it is a lapidary's manual and thorough guide to the way to getting the most out of

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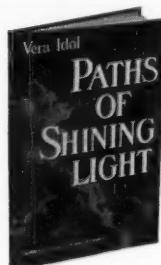
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JUNE-JULY, 1956 VOL. 49, NO. 6

Published by the **AMERICAN NATURE ASSOCIATION** to stimulate public interest in every phase of nature and the out-of-doors, and devoted to the practical conservation of the great natural resources of America

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SUBSCRIPTION RATE

NATURE MAGAZINE is published monthly, October to May, inclusive, bimonthly, June to September, inclusive, by the American Nature Association. Entered as second-class matter May 31, 1927, at the post office at Washington, D. C., U. S. A., and accepted for mailing purposes at the special flat rate of postage provided for in the United States Postal Act of October 3, 1917, and February 28, 1925. U. S. and Canada one year, \$4; foreign, \$1 extra; two years \$7; life, \$100.

Publication and Editorial Office, 1214 16th Street, N. W., Washington 6, D. C. Additional office of publication, Easton, Pa.

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Nature Magazine past and present, is indexed in The Reader's Guide in your public library.

•Arctic Wilderness

By Robert Marshall
Edited, with an Introduction,
by George C. Marshall
Foreword by A. Starker
Leopold

Based on a series of diaries and letters of the late Robert Marshall, naturalist, forester, conservationist, and explorer, this book recounts his experiences in Alaska with sudden floods, clouds of mosquitoes, grizzly bears, treacherous bogs, and most of all his exhilaration in discovering and mapping unknown wilderness. An exceptionally vivid literary chronicle by the author of "Arctic Village." Illus. \$7.75

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rockhounding. The author writes against a background of ample experience and with a recognition of the needs of the amateur. For example, he includes, for the first time in print, we understand, a large list of minerals that may be used by the amateur, and includes details as to their treatment. A first chapter shows the beginner how to get started, and succeeding chapters instruct on the various intricacies of sawing, grinding, lapping, sanding, polishing, and of other treatment of stones. Other chapters treat with cabochon gems and faceting, achievements that would, we are sure, be beyond us, but not the enthusiastic lapidary hobbyist. Other useful data rounds out what appears to be the most complete book on the treatment of gem stones. R.W.W.

Briefly Noted

Hawks. By Charles L. Ripper. New York. 1956. William Morrow and Company. 64 pages. Illustrated by the author. \$2.00. An excellent and splendidly illustrated discussion of the hawks, their interest and importance as a part of our avifauna.

Bird Life. By Niko Tinbergen. New York. 1956. Oxford University Press. 64 pages. Illustrated. \$2.75. Bird observation abroad and what was learned from it.

Deserts. By Delia Goetz. New York. 1956. William Morrow and Company. 64 pages. Illustrated by Louis Darling. \$2.00. About the desert and its plant and animal life. For the younger reader.

Poems. By Christina Rossetti. New York. 1956. Philosophical Library. 106 pages. \$2.75. A selection of the best among this poet's works.

Our Senses and How They Work. By Herbert S. Zim. New York. 1956. William Morrow and Company. 64 pages. Illustrated by Herschel Wartik. \$2.00. A Morrow Junior Book about sight, hearing, smell, taste and touch, and how these senses operate.

Electronics. By A. W. Keen. New York. 1956. Philosophical Library. 256 pages. Illustrated. \$7.50. The science of electronics in action by a British scientist.

Essays on Science. By Herman Augustus Spoehr. Stanford, California. 1956. Stanford University Press. 220 pages. \$5.00. Essays reflecting this scientist's concern both with science and its social implications.

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Nature IN PRINT

By HOWARD ZAHNISER

Wilderness In Our Time

A FEW YEARS AGO, in the Spring, 1948, issue of *The Living Wilderness*, Sigurd F. Olson wrote a "Quetico Superior Elegy" describing an inspiring canoe trip that he had made with Robert Marshall in the summer of 1937. "A couple of generations before," said Sig of Bob in that article, "he would have led exploring expeditions into the West. But now, with most of the last frontiers opened up, he sensed, more than any man I knew, the worthwhileness of wilderness as a way of life, its stimulation and challenge to all men with even a hint of pioneering blood in their veins. And, believing that, he threw all of his great energy into the fight to save a vestige of wilderness experience for all those who felt its need."

Thus Sigurd F. Olson, the author of one newly published book that I have now before me—*The Singing Wilderness*, it is called—wrote of the author of another that has come to me almost simultaneously—*Arctic Wilderness*, by Robert Marshall. The editor myself of that magazine, *The Living Wilderness*, in which Sig wrote, I have remembered the article and, looking back, have noted that as editor I then speculated that "few wilderness excursions could be more eagerly shared by readers than this canoe trip with Sig Olson and Bob Marshall," and, identifying the two for my readers, wrote thus:

"Only the most recent newcomers will be unacquainted with Robert Marshall, who until his untimely death in 1940 was the Nation's leading advocate of wilderness preservation—a prime inspirer and founder of The Wilderness Society, at the time of his death chief of the U.S. Forest Service's Division of Recreation and Lands, and the founder of the Robert Marshall Wilderness Fund 'to increase the knowledge of the citizens of the United States as to the importance and necessity of maintaining wilderness conditions in outdoor America.' Sig Olson, of Ely, Minnesota, long identified with efforts to preserve the wilderness canoe country," I continued eight years

ago, "is an author and lecturer now serving as wilderness ecologist for the Izaak Walton League of America and a consultant to The Wilderness Society and the President's Quetico-Superior Committee."

Interpreter of wilderness

Add eight years and the presidency of the National Parks Association to this statement, and it can still stand as an introduction for the author of this new volume *The Singing Wilderness*—a collection of the most delightful and most sensitive characterizations of the wilderness canoe country by its most delightful and most sensitive interpreter. In the intervening years Sig has become more and more deeply identified with the ever-increasing efforts to preserve this great canoe wilderness. His knowledge and eloquence have grown with the years, and his devotion has been proved again and again. A collection of his wilderness writings is a rich anticipation, indeed.

Nor, in the opinion of this reviewer, need anyone fear disappointment in the anticipation. Some months ago this anticipation began for me with the privilege of seeing an assembled manuscript with a title derived from the ballade by Oscar Fay Adams, "Where Are the Pipes of Pan?" The poem came, of course, from that delightful nineteenth century collection dedicated to Robert Louis Stevenson, which ever and anon appears in some second-hand book store, and is entitled *Ballades and Rondeaux, Chants, Royal, Sestinas, Willanelles, etc.* Selected, with Chapter on the Various Forms, by Gleeson White. Here is the poem:

Where Are The Pipes of Pan?

In these prosaic days
Of politics and trade,
Where seldom fancy lays
Her touch on man or maid,
The sounds are fled that strayed
Along sweet streams that ran;
Of song the world's afraid;
Where are the Pipes of Pan?

Within the busy maze
Wherein our feet are stayed,
There roam no gleesome fays

Like those which once repaid
His sight who first essayed
The stream of song to span,
Those spirits all are laid.
Where are the Pipes of Pan?

Dry now the poet's bays;
Of song-robes disarrayed
He hears not now the praise
Which erst those won who played
On pipes of rushes made,
Before the dull days began
And love of song decayed.
Where are the Pipes of Pan?

Envoy

Prince, all our pleasure fade;
Vain all the toils of man;
And fancy cries dismayed,
Where are the Pipes of Pan?

Those who know better about such things have laid aside "The Pipes of Pan" as a title for these prose lyrics of Sig's in favor of one that is more readily meaningful. An excellent one it is, too, for in *The Singing Wilderness* is surely a phrase that Pan could pipe, and in its phrase is no disguising Sig Olson's contributions to "these prosaic days/Of politics and trade," his recapturing again the fled songs that "strayed/Along sweet streams that ran." This book takes us back beyond "the busy maze/Wherein our feet are stayed," to a natural world that goes back "Before the dull days began." No reader whose ears are pleased with the title *The Singing Wilderness* need fear disappointment in this volume, for which its composer has rehearsed with long devotion on the Pipes of Pan, having not only found where they are but how also to release their music.

Wild, exciting book

A different, amazingly wilder, exciting book is Robert Marshall's *Arctic Wilderness*. If Sig Olson's *The Singing Wilderness* is a collection of lyrics, this *Arctic Wilderness* is a bold epic. Again and again Sig goes into his beloved wilderness knowing the joy and the beauty ahead of him, the hardships yes, the test of a virile willingness to endure, but nevertheless the sure reassurance of oneness with the environment of essential loveliness, and remarkably often with the conscious wish to savor again a quality of the wilderness he already knows. Bob Marshall in the journeys his book records tries himself in a stark wilderness rarely if ever visited by other men and glories



*Captures the grandeur
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of our wilderness heritage*

THE SINGING WILDERNESS

by
SIGURD F. OLSON

The Singing Wilderness has to do with the calling of loons, northern lights, and the great silences of a land lying northwest of Lake Superior. It is concerned with the simple joys, the timelessness and perspective found in a way of life which is close to the past.

In it, Mr. Olson follows the seasons through the wilderness lake country of the Quetico-Superior area of northern Minnesota and adjoining Canada. Not content merely to describe, he probes for meanings that lead the reader to a more revealing way of looking at the out-of-doors and a deeper sense of its eternal values and that recall our bonds to nature and the satisfactions of a simpler way of living.

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in struggles and adventures with the unknown. Sig, in the words I have already quoted, speculated that "a couple of generations ago" Bob would have led exploring expeditions. *Arctic Wilderness* shows that he did so even in our own generation, finding with his keen sense of wilderness a land in our own Territory of Alaska where the course of the streams were still unknown and many of the mountains, streams, and valleys still unnamed. Here indeed is a great wild book, based on the field-written journals and the letters of a late-comer in American exploration who had both the good fortune and intrepidity to find and explore "a great reach of arctic wilderness." It is a wilderness chronicle with value and excitement that will surely last long in the literature of exploration, of Alaska, and of wilderness.

A rare privilege

Here then are two books of the wilderness that offer a rare privilege, in this spring and summer of 1956—the privilege of experiencing with contemporaries both the hazardous wild adventure of the unknown and the renewed, still adventurous return again and again to the wilderness that in truth is our homeland.

It is our privilege to share this experience as readers, and our appreciation is deepened—both of Bob Marshall and Sig Olson—knowing that they have both contributed notably also to the preservation of areas of wilderness where any of us can still know in some degree these experiences for ourselves, and cherish them as bequests to those who may be our successors.

Arctic Wilderness. By Robert Marshall. Edited, with an introduction, by George Marshall. Berkeley and Los Angeles: University of California Press. 1956. xxvi + 171 pp. (6½ x 9¾ in.), with foreword by A. Starker Leopold, 30 photographs by Robert Marshall in 25 plates, tipped-in folding map of "Northern Koyukuk Drainage," 5 text maps, and index. \$3.75.

The Singing Wilderness. By Sigurd F. Olson. New York: Alfred A. Knopf. 1956. ix + 246 pp. (5⅓ x 6⅔ in.) with 38 drawings by Francis Lee Jaques, frontispiece map by Palacios, and a note on the type. \$4. (Published simultaneously in Canada by McClelland and Stewart Limited.)

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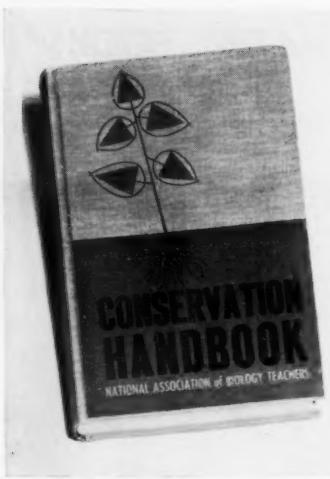
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"Practical and useful" is the comment most often heard about the *Conservation Handbook* published by the National Association of Biology Teachers. It should be, since it is the result of a three-year program of the NABT Conservation Committee, a program that covered the entire United States. Through this program, which was financed in part by a grant of \$10,000 from the American Nature Association, practical experience in teaching conservation in a wide variety of areas and situations was brought together. The best was extracted from this experience.

Of special value to teachers, this book is equally useful to professional conservationists working with teachers, schools and youth groups. It also has its application to the educational divisions of State conservation commissions. As an appendix the book contains a 27-page listing of source materials for teaching conservation, the largest and most comprehensive such list available. Copies of this book may be ordered from Dr. Richard L. Weaver, P.O. Box 2073, Ann Arbor, Michigan. It lists for four dollars, with a twenty percent discount to schools and teachers.

Wildlife Conference

Announcement has been made by the Wildlife Management Institute of Washington, D.C., that the Twenty-Second North American Wildlife Conference will be held in the nation's capital March 4 to 6, 1957. This annual gathering brings together more than one thousand conservation authorities, outdoor writers, administrators and sportsmen from all over North America.

A.F.A. Forester

The American Forestry Association, with headquarters in Washington, D.C., announces the appointment of Kenneth B. Pomeroy as its Chief Forester, effective July 1. He replaces Lowell Besley, who has accepted a position with the Pulp and Paper Research Institute in Canada. Mr. Pomeroy is a forest management research specialist and is presently chief of forest management at the Northeastern Forest Experiment Station at Upper Darby, Pennsylvania.

Conservation Education

A survey is now under way to discover how each State is organized to give leadership in conservation and resource-use education. The study is directed by Dr. Richard L. Weaver, Associate Professor of Conservation in the School of Natural Resources, University of Michigan, Ann Arbor. The program has been made possible by a research grant by the Horace H. Rackham School of Graduate Studies.

All in the Auto

Were it not for our natural resources we would not be riding around in automobiles. This is graphically brought out in a map that has been prepared by the Automobile Manufacturers Association, 320 New Center Building, Detroit 2, Michigan. The map is available to teachers.

Wildlife Refuges

"Duck Stamps and Wildlife Refuges" by John L. Farley has been published as Circular 37 of the U.S. Fish and Wildlife Service, Department of the Interior, to explain the manner in which funds from the sale of the Migratory Bird Hunting Stamp, or "Duck Stamp," are used in the migratory waterfowl refuge program. This 22-page bulletin describes the history of this important program and the philosophy back of its development.

Lehigh Tree Farm

Lehigh University, Bethlehem, Pennsylvania, has had certified the first tree farm operated by a college or university in the Keystone State. The area is 450 acres of a 480-acre tract left to the university by the will of Albert Brodhead, a graduate of the class of 1888. The farm will be administered according to approved land-use policies, and will be an adjunct of the conservation major offered in the university's curriculum.



Thwarting Squirrels

It is not that squirrels are not interesting creatures to have about, but they often provide unfair competition with birds for food. Also, squirrels usually can manage better than many birds under winter conditions. The ingenuity of these busy little rodents in defeating attempts to keep them away from bird feeders is remarkable. However, Florence L. Durow of Westfield, New Jersey, worked out a successful idea. She cut some large juice cans in half with tin snips, first making holes in the can where they will be attached to the pole, which is topped by the feeding station. The picture above shows how this was done. Miss Durow advises painting the tin to inhibit rust. Part of the fun, she says, is watching the squirrels while they try to figure out a way of defeating this protection.

Cypress Swamp

One of the last remaining bald cypress swamps in the middle-eastern coastal area is located on Battle Creek near Prince Frederick, in southern Maryland, about forty miles from Washington, D.C. It is a showplace of trees that are virtually a thing of the past, one giant tree measuring nearly eighteen feet in circumference. A one-hundred-acre area is designated for preservation by the Nature Conservancy, which is dedicated to saving a few samples of natural communities typical of an earlier day. Contributions toward saving this outstanding area may be sent to Nature Conservancy, 4200 22nd St., N.E., Washington 18, D.C.

Contents noted

BY THE EDITOR

A NEW SOCIETY IS BEING FORMED. If we may be permitted one of our occasional excursions into etymology, we will announce this organization's temporary name as the Association to Confine the Word Trek to the African Veldt Where It Belongs. We read that President Eisenhower trekked around the golf course; the Audubon Society members trekked through the woods looking for birds; a lot of ladies trekked to the department store on Friday bargain day; the coyote trekked across the plains looking for gophers, and so on *ad infinitum* and, above all, *ad nauseam*. "Trek" is a South African word used to describe arduous travel by oxen-drawn vehicle. As such it is a fine word, and properly could be applied in our country only to the historic travels of our covered wagon pioneers. Yet writers have developed a positive mania for the word of late, and in manuscripts that have come our way it is used in some of the most ludicrous associations imaginable. Membership in our new society may be achieved by the simple process of placing the right hand on Webster's Unabridged Dictionary, or any of its lesser counterparts, and swearing to exorcise "trek" from one's vocabulary.

THE UPPER COLORADO STORAGE PROJECT BILL has been signed into law by President Eisenhower. The controversial Echo Park Dam, against which conservationists fought so zealously and successfully, is not in the bill, which also prohibits invasion of any area in the National Park system in the course of the development of this project. Appropriations still must be made to carry the Act into effect. Word of the signing was acclaimed in Utah and adjoining interested States. Here and there were indications that some diehards have not yet given up on Echo Park Dam and hope to put it over eventually. However, the good faith of the principals in the agreement should not be questioned. Furthermore, as a part of its "Mission 66" planning, the National Park Service has allocated substantial sums for the development of the accessibility of Dinosaur National Monument, which should also be cause for some acclaim. Recently introduced in Congress is a bill that would transfer Dinosaur National Monument to the status of a National Park, a designation of which it is eminently worthy.

A BIRD'S LIFE IS A HARD ONE. At least it was for a wounded American bittern that had the misfortune to turn up in a yard in Rock City, New York. A six-year-old youngster was playing there when the bird, probably

famished and trying to find something to eat, appeared. The boy screamed and his mother came to the rescue with a mop, finally driving the two-foot-high bird into the barn and slamming the door. The State police were called and a patrolman settled matters with a revolver bullet through the bittern's head. It was found that the bird's wing had been broken by buckshot or accident, so it could not fly south with its fellows in fall migration. With its normal swamp habitat frozen, the bittern was in a bad way and no doubt is better off stuffed or as a study skin. The sad side, however, is that newspaper reaction was to applaud the demise of this interesting bird. Such ignorant panic about wild creatures is discouraging. The first reaction seems to be that if you do not know what it is, kill it. Understandably the appearance of the bird might have been frightening to the youngster, but why adults would see such menace in the bird is difficult to comprehend. A number of our readers have indignantly sent us clippings of the newspaper stories about this incident.

NASH MOTORS' CONSERVATION AWARDS will be made again this year, according to an announcement by George Romney, president of American Motors Corporation. In doing so he said that "the automobile industry has a definite obligation to conservation of natural resources since so much enjoyment of the outdoors is derived from the automobile." There are twenty awards, ten to professional conservationists and ten to non-professionals. Nominations may be made by letter, with supporting documentation, before August 15, 1956, and sent to Nash Conservation Awards Program, Room 1700, 745 Fifth Avenue, New York City. Mr. Romney also points out that the program is "to help direct public attention to the work of those who are actually on the conservation firing line, and to help the public understand how and why this work is important. We hope to help Americans understand that all phases of conservation work are inter-related; that we cannot have good fishing, for example, unless we also have good forestry management and good soil management practices."

OUR LITTLE BAND OF WHOOPING CRANES took off from Texas on their long flight north with the good wishes of all for a successful trip. (We have seen this flight called a "trek.") They left behind, however, a recording of their love duet made by Dr. Arthur A. Allen of Cornell, and his son David, at the Aransas National Wildlife Refuge, winter home of the birds. This was the first recording of their love talk. While this was being done, James Hartshorne was making a similar record of the love duet of the rare trumpeter swan at the Red Rocks Lakes Refuge in Montana, also a "first." The Cornell people have already gotten a recording of the voice of the rare—if not extinct—ivory-billed wood-pecker.

R.W.W.



A broad-winged hawk with a shattered wing. Hundreds of birds, crippled like this one, disappear into the dense brush, there to die of thirst and hunger.

PHOTOGRAPH BY THE AUTHOR

A bottleneck in hawk protection is on

Pennsylvania's Bloody Ridges

RECENTLY I talked with an elderly sportsman who told me that forty years ago he and his friends shot hawks, all kinds of hawks, from blinds atop the ridge of Shamokin, Pennsylvania. At the end of a day of shooting, the birds, this man said, "lay in piles two to three feet deep." I have heard many stories like this, from oldtimers among gunners. Invariably these men, usually keen outdoorsmen, add that nowadays only a fraction of the numbers of hawks pass down these same ridges as could be seen in the old days. Nevertheless, the shambles at Shamokin—and at many other places in Pennsylvania—may still be seen by anyone who has the stomach to investigate them. It is not a pleasant thing to see.

I would like to report what I know of this scandalous situation in the great Commonwealth of Pennsylvania, which takes pride in its progressive policies and prac-

tices toward wildlife. But first let us review briefly certain hopeful signs, and offsetting facts that fill us with despair as we struggle to save our vanishing birds of prey.

There is no question that great progress has been made, during the past decade or so, to provide "a fair deal for the birds of prey" through legal protection. We rarely hear of "vermin" extermination contests, so popular a generation ago. Instead we have intensive, nation-wide hawk-protection campaigns. Education of the public through magazine articles, books, the radio and television has accomplished wonders. We have been inspired by the example of Connecticut, the first State to achieve protection for all predatory birds. We salute the sportsmen of Michigan who helped push through the model hawk law of that State. Indiana provides legal protection for all its hawks and owls. Many other states, including Pennsylvania, have fairly good



PHOTOGRAPH BY FREDERICK WETZEL

A broad-wing, one of the "protected" hawks, hung defiantly from one of the posters of the Pennsylvania Game Commission. Such educational measures have no meaning to the hawk-hunters.

By MAURICE BROUN

Curator, Hawk Mountain Sanctuary

hawk laws, but all too often these laws are ineffective, unenforced, or unenforceable.

A vast amount of scientific evidence, and a mountain of literature pointing up the economic worth of our hawks and owls is available to any literate farmer or hunter. That these birds are part of the "web of life," and that 85 percent of their food consists of mice, rats and other rodents, has been preached by biological scientists for more than sixty years.

In spite of all the evidence in their favor, in spite of our best efforts for their preservation, our birds of prey face desperate odds for survival. As our population expands, ever-increasing legions of gunners comb shrinking wildlife habitats and, if game birds are scarce, no hawk is safe that appears within range of a gunsight. A hawk seems always an irresistible target. It does not matter to many men that the bird that is shot and left to rot may have been protected by laws. There will always be people who refuse to learn, and those who kill for amusement, in spite of laws.

Few conservationists are aware of the ap-

palling slaughter of hawks at game farms throughout the land. Many thousands of these birds, especially the beneficial *Buteos* (the broad winged, mouse-eating hawks) are pole-trapped at game farms in States where they are supposedly protected by laws. At one Wisconsin game farm, for example, 532 red-tailed hawks were caught and killed in pole-traps during 1953. There is an earnest attempt made at all game farms to hush-hush these wholesale trappings.

Does this trapping accomplish anything? Is it necessary? True, young pheasants must be protected in their pens. But why can not these pens be enclosed with wire mesh? Since the use of large quantities of grain at game farms obviously attracts rodents, it is quite possible that many of the unfortunate victims of pole-traps have been attracted by mice and rats. In any event, flagrant violations of their own laws are committed in New York, Wisconsin, Pennsylvania, to name but a few States that "protect" certain hawks and owls, yet pole-trap the birds on game farms.

The wholesale slaughter of migrating hawks at concentration points along coastal and mountain flyways cancels out the excellent hawk protective efforts of the regions whence these birds originate. In Pennsylvania, hawk-shooting along the ridges each fall is a tradition. It will probably take an act of Congress, and I do not say this facetiously, to put an end to this tradition. For hawk-shooting as an organized "sport" in the Keystone State has been going on for at least seventy years—ever since the infamous "Scalp" Act of 1885. In the first

A hawk-shooting blind made of brush and trees. Live pigeons tied to poles are often used to lure hawks to certain death.

PHOTOGRAPH BY THE AUTHOR





PHOTOGRAPH BY LON ELLIS

A male peregrine falcon killed at Little Gap, Pennsylvania. This vanishing species is a frequent victim at the hawk-shooting blinds along the Blue Mountain.

An immature red-tailed hawk pole-trapped on the Pennsylvania Game Farm near Washingtonville by the State Game Commission.

PHOTOGRAPH BY DENNIS FETZER

year and a half of that classic example of lethal legislation bounties were paid on 125,000 hawks and owls!

Migrating hawks run the gantlet in a number of places in Pennsylvania; at Larksville Mountain near Wilkes-Barre, at Shadyside, on Tuscarora Mountain near Chambersburg, to name but a few. By far the greatest massacres, however, take place along the Blue Mountain (Kittatinny Ridge), of which Hawk Mountain, with its 1418 acres dedicated to hawk protection and education is only a minute part. There are eight major hawk-shooting areas, each with scores of shooting stands, along a sixty-mile stretch of this mountain, from Wind Gap to Bethel. It is my carefully considered belief, based on many conversations with gunners, first-hand observation of their shooting, the numbers of dead hawks at the blinds (as many as 287

freshly killed birds at one blind), that on a single favorable flight day upwards of fifteen hundred hawks may be killed along this sixty-mile death trap. On favorable weekends during the fall the long ridge—"bloody ridge"—is infested with so many gunners it would take an army of law-enforcement officers to ferret out the law-breakers.

Industry and the motoring age have made the mountain flyways readily accessible. Broad, paved highways and power lines lead over the mountains and directly to the shooting areas. The Appalachian Trail, threading its way along the summit of the Blue Mountain, connects all the shooting areas and, unwittingly, the Trail has been responsible for the death of countless thousands of hawks.

Most hawk-shooting occurs on weekends. The shooting takes place from blinds, some elaborately constructed of brush, trees or rocks. Invariably these blinds are a litter of empty beer-cans, whiskey bottles, lunch-wrappers, expended cartridges, pigeon lures, carcasses of hawks, with now and then the remains of flickers, towhees, jays, cardinals—almost anything with wings. At Lehigh Furnace Gap, near Palmerton, there are at least thirty well-concealed blinds. Shooting often takes place, however, across roadsides, in open violation of the laws.

One of the most extraordinary blinds of which I know is that at a power line atop the ridge near Route 83, only fifteen miles west of Hawk Mountain Sanctuary. This blind, well concealed, is 165 feet long. All the trees



These people, interested in watching the migration flights of hawks on the wing, display a part of the shambles found in a single blind at Little Gap, above Danielsville. There were thirty dead red-tails and several red-shoulders, all "protected" hawks.

PHOTOGRAPH BY THE AUTHOR



here, in an area covering about one-half acre, have been topped to improve the shooting. *This is State-owned land, administered by the Pennsylvania Game Commission.* Here, on a good hawk flight day, a few hunters can knock down every low-flying hawk that has safely passed the Sanctuary. It was here, one day in October, 1953, that a friend and I saved at least 150 hawks by our mere presence. The gunners, unable to identify the low-flying birds, did not wish to be seen shooting at protected species. One by one the men could be seen slinking away.

Decoys, used at most blinds, consist of pigeons, live horned owls, wooden owls, dead or wounded hawks, and crows. On several occasions I have found dead "protected" birds—sparrow hawks or red-tailed hawks—that had been used as decoys. Once I found a badly wounded red-tail tied to a fifty-foot length of string. The area was strewn with the lifeless forms of many hawks, large and small, indicating how this tethered red-tail had been made to lure many of its brethren to a cruel fate. Having served the gunners, this bird was left to die. We had to give it a merciful death.

Who are the people who devote their leisure hours to these inhumane and lawless practices? Many are toughs and hooligans from nearby coal regions. But many men, and sometimes women, come from Allentown, Hazleton and smaller communities. Often entire gun-clubs are represented. One man, from Tamaqua, took up a position at Bake Oven Knob every Sunday morning, regardless of weather, during twelve consecutive hawking seasons. Another man, from Slatington, well in his sixties, declared that he had been shooting hawks along the ridge every year since his boyhood. Still another man, with a rage to kill hawks, skipped his work when-

ever a flight shaped up. I have found teen-agers, unaccompanied by responsible older people, blazing away at ospreys and red-tails.

Some hunters would rather shoot hawks along the ridge than pursue legitimate quarry. Hawk-shooters are a law unto themselves. They refuse to recognize the facts of the utility of hawks; they refuse to abide by the laws governing hawk protection; they resent bitterly any interference in their sport. Many a protectionist has been threatened with violence for interfering. Most hawk-shooters that I have encountered insist that *all* predatory creatures should be killed—the Jack Miner attitude—an attitude they seize upon to justify their itch to use hawks as targets.

If any hawk stoops to the pigeon decoys, it is a "bad" hawk. Since red-tails often dive into the lures, they are always shot—an open admission made by many gunners. The rare and valuable peregrine falcon is easily decoyed to the blinds; few of these magnificent birds escape down the Blue Mountain. *Hawk-shooters have gotten away with murder for so long that the act and fact of promiscuous shooting of all kinds of hawks and other birds has fostered lawlessness, and violations of the game code.*

Where does the Pennsylvania Game Commission, whose responsibility it is to enforce the laws, fit into this grim picture? In 1937, three years after the establishment of Hawk Mountain Sanctuary, the Game Commission made a significant forward step in the movement toward real hawk conservation. The Commission put through legislation protecting all hawks, except the goshawk, the Cooper's hawk and the sharp-shinned hawk. In June, 1951, the Commission repealed the \$5 bounty on the goshawk, thus removing the incentive

most gunners had to shoot any hawk in the hope that the bird would prove to be a goshawk. The Game Commission's sanction of the killing of these *Accipitrine* species, however, remains an open invitation to kill all hawks, since few gunners can tell the birds apart.

In recent years the Game Commission has had printed, and posted along the mountains, enormous numbers of pictures and placards, showing the "protected" species of hawks, warning the gunners not to shoot these birds. This is an attempt to educate the hawk-shooters. But this campaign has failed dismally. The posters have not stopped the cannonading, nor the abuses, at the 300-odd shooting sites along the Blue Mountain, on the ridges above Shamokin, Larksville, and elsewhere in this area.

Game Protectors have been ordered, time and again, to patrol the shooting areas. But the Game Protectors are few in number, always overworked, and they find it hopeless to cope with the hawk-shooting. The Game Protector must always wear a uniform. When an officer appears anywhere on the ridges, word quickly gets around and the gunners melt away, only to pop up at other shooting sites. One officer told me that he finds many dead hawks of "protected" species, but that in four seasons he had been unable to pin a conviction on any gunner. Another Game Protector candidly told me that he had no use for any hawk.

Some of the worst abuses of the hawk-shooting fraternity are perpetrated on State Game Lands. The big blind near Route 83, previously mentioned, is on State Game Land #110. Fifty percent of the shooting at Bake Oven Knob and at Lehigh Furnace Gap takes place on Game Land #107. We have urged the Pennsylvania Game Commission to convert such game lands into refuge units. But the Commission has consistently ignored this suggestion and, by failing to establish refuges, the Commission invites endless violations of its Game Code, on its own lands.

The erection of blinds on the Game Lands is a manifest violation of the Pennsylvania Game Laws, as is the kindling of fires or the dropping of cigarettes. All are punishable by fines of \$25. Such breaches of the law are committed endlessly each day, by hawk-shooters, but we have never heard of an arrest.

Another twist that gives the edge to the shooters is that protectionists have been ordered by Game Protectors *not* to pick up dead hawks of protected species, for "it is unlawful for any person, at any time...to have such birds, living or dead...in his possession." So the gunners can continue to massacre all hawks with impunity. Should an interested observer see a "protected" species of hawk shot down, and if he is determined to see justice meted out, he must (if he is lucky enough to locate the

bird) find a Game Protector (again, if he is lucky enough to find one) and lead the officer to the evidence. It is necessary to prove who shot the bird. But how is one to obtain the evidence, especially when seven or eight men may shoot at one bird?

The killing of a protected species of hawk is punishable by a ten-dollar fine and court costs. You could count on the fingers of one hand the numbers of such arrests and prosecutions that have been made during the past dozen years. Most magistrates in the hawk-shooting regions, interested in votes, simply will not touch such cases. Realizing this, it takes an exceptionally courageous and persevering Game Protector—and I know of only one—who will press charges on what must be an air-tight case.

There is no use kidding ourselves that hawks are "protected" as long as irresponsible gunners are allowed to mow down the birds at concentration points. It is impossible to abolish these shambles with the existing law-enforcement machinery, the inadequacy of which is almost as shocking as the hawk-slaughter itself.

The Pennsylvania Game Commission is in an extremely difficult position in regard to

this long-standing evil. In Pennsylvania there were in 1955 some 900,000 licensed hunters—twice as many hunters as in all the New England States together—whose license fees are the life-blood of the Commission's operations. The hunters are well organized and, so far as I have been able to determine, they pretty much control the Game Commission, through the large membership of the Pennsylvania Federation of Sportsmen. To be sure, only a small number of these hunters are hawk-shooters, but they constitute a highly vocal, aggressive minority. Perhaps this is why certain of the State Game Lands are the happy hunting grounds of the hawk-shooters. These Game Lands could easily be made into refuges. And it would help if Game Protectors were called Conservation Officers. Since hawks are not game, it is no wonder that the Pennsylvania Game Protectors do not take hawk protection seriously. It would help, too, if bird-watchers took an active interest in the problem, visiting the shooting areas to gather the evidence so urgently needed to prosecute violators. Finally, it is imperative that we focus public opinion on this atrocity; this crime against Nature, which has extended through several generations and which has taken a terrible toll.

Our ultimate objective should be legislation, under the Migratory Bird Treaties, providing protection for all hawks during migrations. Until blanket protection is given to all migrating hawks, real law enforcement is impossible. Once this legislative hurdle is achieved, there would be no excuse for bands of armed men to bathe the ridges in blood during hawk-migrations.

DOES GOD KEEP COUNT?

*An oncoming monster! A thud! A blur!
A trembling creature stricken to die.
A pitiful, prostrate bit of bruised fur
Oblivious now to cars rushing by.
He scampered so madly to get across;
But on, ever on, with speed paramount,
Came Juggernaut demons to kill or toss.
If "sparrows are numbered," does God keep count?*

Myrtle T. Wilkins



Automobiles no longer drive Fall River Road, but hikers start out from this point to explore the isolated and exciting old route to Fall River Pass.



Fall River Road in Rocky Mountain National Park looking back at Sundance Mountain. The road was once a test of mountain driving for the courageous.

Peace and Nature rule the heights if you take

The Lone Road Up

By VIRGINIA S. EIFERT

Photographs by the Author

THE gentians are very blue. The alpine firs are very tall, and their silver-studded cones glitter in the Colorado sunshine. Wild creatures are wild, and man, even in midsummer, is a rarity at which they peer in curiosity. A high, lone, virtually deserted road climbs from 8500 feet in a placid valley of great ponderosa pines to the bare, windy tundra at 11,797 feet. This is Fall River Road in Rocky Mountain National Park.

During the tourist season, when more than a million people pour into this park within a space of three months, it is difficult to find much seclusion, peace, or isolation except in remote spots that are not easy to reach. The well-known trails are crowded, and the easy-access places have too many people and horses, too many peanut-shells and overly tame ground squirrels, for any sense of wilderness to persist.

It is excellent that our national parks are used; this is their purpose. But when too many places are too accessible, or wilderness areas are overdeveloped at the expense of their true wilderness, they are ruined for their true purpose. In the other direction, however, stands Fall River Road; for in it lie some delightful possibilities if it can be neglected for a while.

Fall River Road was built between 1912 and 1920 by convict labor brought up from Canon City, Colorado. The unpaved, gravelled road was engineered to get

horses, model-T Fords, and Stanley Steamers over the great crest of mountains, standing between the eastern Rockies and the western slope, to Grand Lake. The road was gouged out of the sunny side of the natural pass left by the Fall River Glacier between the Mummy Range and Sundance Mountain. To make the trip was an adventure, for the road rose fast in sharp switchbacks, was narrow, and clung with careless abandon to the edge of nothing. In all its precarious eleven miles there was neither rescue station nor telephone. This was later remedied by the Willow Park Ranger Station and telephone, some eight miles up.

Meanwhile, however, the great increase in traffic into the park area demanded a better road. In the 1930's the splendid, thrilling Trail Ridge Road was built. Over it, on easy grades, cars can climb more safely and easily to Fall River Pass. The mileage was greater, the scenery more breath-taking. The old Fall River Road was decreed a one-way-up road, was recommended only to experienced and level-headed mountain drivers, and, on occasion, was known to scare even these hardy souls.

But rock slides in the past year or so closed the old road to the motor traffic that used it so seldom and needed it so little. The gate at Chasm Falls, three miles up from Horseshoe Park, was locked. In the selfish interest of hikers and naturalists, one may hope that it



Chasm Falls is three miles up Fall River Road. At this point the icy water of Fall River tumbles down its steepest descent along the old road.

The cones of alpine fir show silvery blobs of resin, which glitter like ice in the sunshine.

Arctic gentian grows in late summer on the open tundra above 11,000 feet. It is white, with green stripes and purple speckles.



will remain locked and the road unrepaired. In its present state, it is ideal for hikers and horseback riders, and, because it is a fairly long trip, it is used by few. Its easily reached isolation and beauty should be cherished by the Park Service.

Fall River Road begins innocently enough where it turns out of Trail Ridge Road at the west end of Horseshoe Park. Soon it begins to climb. Then the gradient is steep, the curves sharp. There are level, no-nonsense right-angled turns that were designed for those early, extinct, short, high-wheeled motor cars, and consequently unfit for today's long, low-slung numbers. Cars, however, may still go as far as Chasm Falls.

Fall River pours foaming over Chasm Falls. Here, although you may find a good many people admiring the Falls on an August day, the locked gate barring the road above seems to be a barrier to the majority of people. To pass beyond the magic bars is to enter a strange world of alpine silence, a silence only heightened by the cheeping of mountain chickadees, pygmy nuthatches, and juncos, the gentle talking of a dusky grouse, the flash of

the alpine three-toed woodpecker flying to an aspen, or the distant voice of nutcrackers or Canada jays, which are somehow different and less arrogant than in the tourist spots where they are fed. Within a distance of a few yards, you are completely isolated and out of sight of civilization, with only the road to remind you that man has been here.

In the shadowed fir forest along the road there are the tiny, fragrant white blossoms of star pyrola, and always that cool, forest-scented dampness that is part of the spray-washed woods along the tumbling river where ouzels sing.

Fall River is born in the banks of perpetual snow high above timberline, up in that vast, glacier-carved cirque lying just below Fall River Pass. In its passage down the gouged-out valley to the levels of Horseshoe Park, before it goes tumbling down another thousand feet to Estes Park to join the Thompson River, the river, although narrow most of the year, goes at a great speed. In its eleven-mile descent from its source, it drops more than 3200 feet.

The road, however, is not so direct. It makes many sharp, rising switchbacks in constantly changing country. Suddenly it comes upon a small, grassy hollow dappled with sunshine, in the middle of which, set at two levels on the slope, is a startling little dwelling that looks like the house of the witch in a fairy story. The incredible house, put together of slabs of odds and ends of lumber, has a sharply conical roof to shed heavy snow and so avoid being crushed by its weight. It has a tumble-down front door and collapsed stone fireplace. Sunlight slants through holes in the roof.

No witch's house, this. Here lived and dreamed one Miner Bill, a mountain man who grubbed in vain on the mountainside in search of the rich copper mine he was sure was there. His diggings are still visible high up, with traces of blue-green rock indicating the scant presence of the copper he sought.

Beyond Miner Bill's cabin, the road climbs steeply again below the pinnacles, against which a golden eagle often soars, or may drift down lightly to perch on a crag. Above Sundance Mountain on the left, a western red-tailed hawk may climb the air currents, with a pair of Clark's nutcrackers tearing after it, in the manner of crows, harrying the hawk until it passes out of their jurisdiction. A broad-tailed hummingbird, announcing its coming with that peculiar jingling that broad-tails make, dashes up to a clump of vivid paintbrush and probes each scarlet tube.

During the climb, you become accustomed to the narrowness of the road, the closing in of the tall spires of the alpine firs and Engelmann spruces, and the mountain walls beyond, so that when the pleasant, sunny meadow of Willow Park suddenly opens ahead, its effect is the more strange and unreal. It is heightened by the apparition of the Ranger Station, seldom used and considerably chewed by porcupines. The Ranger Station stands in the sun, with the glitter of Willow Park and its deer trails before it, and the far, open, shining tundra up in the curve of the gorge.

The words *willow* and *park*, so high in the mountains, connote something quite different from their meanings down in civilization, where a willow is a tall, often weeping tree, and a park is—well, a park. Willow Park, however, is simply a beautiful, quiet, unutterably peaceful mountain meadow at about 10,000 feet in altitude, set in a bowl of spruces and firs, while the willows filling the meadow are the dwarf alpine kind that are scarcely knee-high to a deer. They are food and shelter for ptarmigan and grouse, browse for deer and elk and sheep. In August, the young white-crowned sparrows flit among them, and there are bright gentians and harebells in bloom everywhere.

It is three miles by the road from Willow Park to Fall River Pass, which is visible on the high horizon, marked by the tiny rectangle that is the museum and shelter house. The road climbs past spikes of pink-purple fireweed, past the rock slides where the little arrogant conies scamper about or sit hunched with noses accusingly raised, yipping their defiance. Chipmunks and ground squirrels along the way have been so unacquainted with human-kind that they have few of the mendicant ways of the rodents at the parking spots, but the conies



Willow Park, eight miles up Fall River Road from Chasm Falls. Dwarf willows in the meadow are surrounded by firs. Beyond lies the tundra above timber-line.



The road climbs past spikes of pink-purple fireweed, one of the many flowers to be seen.



Fall River Road approaches the top of the Pass. Ahead is the museum-shelter and to the left the last of the old snow, often to be seen in August.

seem to be never friendly nor confiding in their ways. Higher now. A wind from the distant mountain tundra sweeps down across the firs and spruces of the high valley, so that the voice of the wind sounds like a surge of surf on the ocean, washing nearer and nearer in a great gush of tree sound, then breaks gently like a cool spray across your face and moves on up the mountainside.

And then, quickly and with finality, the last tall firs are left behind, as if the mountain simply designated this spot as the edge of the forest. Everything beyond is dwarf firs, which crouch behind rocks or lie upon the ground as if to get out of the wind, miniature trees, storm-tortured and old. And then these give way to the open tundra where no tall plant survives the punishing winds or the wild winters that close down nine months of the year.

Upon the flowery tundra are Arctic gentians and moss pinks. Beside a marshy tundra pool where the mountain sheep have left their tracks, grows pink elephantella. Horned larks, pipits, and rosy finches fly up, tweeting. There are always the massive clouds boiling over, darken-

ing, passing, perhaps dropping rain or snow or hail. Then the sun coming out in brilliance again, but the wind is forever cold and pounding.

It is a long pull up the last stretch of the steep road, with marmots curiously watching from the high rocks, a cony barking, a raven soaring, and the museum-shelter in sight, its roof weighted with rocks and timbers to keep it from blowing off, and banks of old snow nearby, even in August. Inside the shelter there are sandwiches and hot coffee and chocolate and pie to refresh and warm the weary and half-frozen. You are among crowds of people again, but you have tasted the beauty of aloneness on a neglected mountain road, and you do not come back to crowds too quickly. Instead, you may sit beside the big windows and watch a far-off herd of elk or deer feeding on the tender greenery watered by snowbanks below the Pass. These snowbanks are the source of Fall River and the remnant of the great glacier that once filled the whole valley and chiseled the original route of the magical old road, which lies down there, all but invisible, on the green mountainside.



Some Call Them "Wild Petunias"

By RALPH J. DONAHUE

Photograph by the Author

ALTHOUGH botanists tell us they are ruellias, we have often heard them called "wild petunias." There is, indeed, some resemblance to our common dooryard petunias; both in the funnel-shaped flowers and in the pale lavender colors. But the petunia belongs to the Nightshade Family and the ruellias to the Acanthus tribe.

The range of the ruellias is said to be largely confined to the eastern coastal States, but some species thrive in Wisconsin; westward to Kansas; southward to Oklahoma and Texas. While their flowers are usually some shade of pink or purple, white is not unknown. The corollas are not always funnel-shaped; some blooms do not open at all. Since these produce seeds, they are called cleistogamous.

The plant shown here is the long-flowered ruellia, *Ruellia humilis*, var. *longiflora*. The plant of this variety is quite "woolly," and, because of this, has sometimes been confused with the hairy ruellia. The long-flowered variety is found over a region extending from southern Illinois, through Missouri; east to Kansas, and south to Louisiana and Texas. It seems to do best in com-



paratively open country.

The name ruellia was given this genus in honor of the early French herbalist, Jean Reulle.





LAKE OF THE OSARKS

PHOTOGRAPH BY THE AUTHOR

JUNE TWILIGHT

*Far from the city's roar and rush
At twilight of a summer's day
There is a solemn, sacred bush
When lake and trees are calm, and pray.*

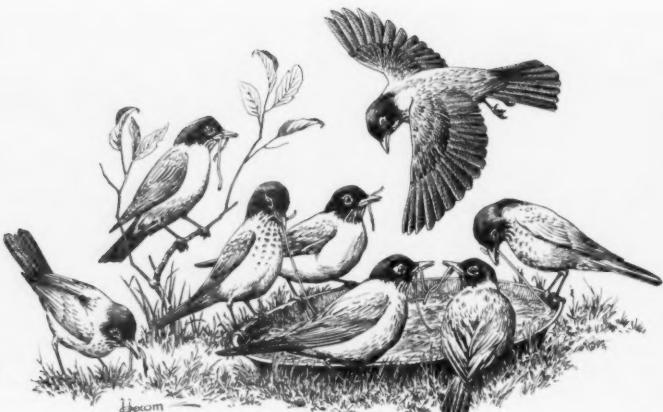
*The silence vast, so deep, so still,
As all of Nature bows the head,
Is broken by a plaintive trill—
A tardy bird speeds late to bed.*

*The insect choir so softly sings,
And Night his blue-black blanket throws
O'er men and circumstance and things,
While sleeps the Earth in sweet repose.*

Albert H. Hindman

The Robins Ate Spaghetti

By ROSE GRIECO



WHILE I do not pretend to know much about animals and plant life, except that they are a constant reminder of God, I observed what may be strange, even to experts on bird-life: Robins will eat spaghetti.

Since our background is Italian, our daily menu leans towards Italian dishes. We also believe in keeping the animal life on our property well fed, and the squirrels and sparrows that reside in our immediate neighborhood have become quite cosmopolitan in their eating habits. They are well acquainted with both Italian and French bread. As for our dog, he waxed strong and lived a gay and active life for thirteen years on a fairly steady diet of meat-balls and spaghetti, ravioli and egg-plant *a la parmigiano*. He ate our Italian dishes with such gusto that one was often tempted to place a glass of red wine beside him.

Since our dog had always been fed in the house, we never had occasion to discover whether spaghetti would be pleasing to wildlife. But one day last summer a dishful of spaghetti, well drenched in meat sauce, had been left from our previous meal. No one was particularly interested in eating it, and I dislike to throw away edible food. Looking into the yard, I noticed some robins pecking speculatively about the garden. They did not seem to be doing very well. "I wonder," I said aloud, and to the world in general.

"What do you wonder?" asked my sister, who was having a cup of tea.

"I wonder if robins would eat spaghetti."

I have wondered many strange things in my time, but the look my sister threw in my direction indicated that this time I had hit the jack-pot.

"Who ever heard of robins eating spaghetti?" she asked. "Just throw it out, and forget about it."

"But the robins look hungry, and they just might enjoy it."

"All I have to say is that if you put it out for them and they don't eat it, it's up to you to pick it back up and throw it into the garbage can." She speaks to me that way because she is older than I am.

Now that I had what amounted to a go-ahead signal, I put the spaghetti in a no-longer-useable pie-tin, and set

it out near the garden. I stood watching it for a few minutes, but nothing happened, so I went back into the house. A short while later, I came out with a book, and, making myself comfortable, began to read.

After a few minutes, I happened to look up, and there was one robin staring thoughtfully at the spaghetti. After observing the loaded pie-tin quizzically, the robin popped her beak into it, and came up with a long strand of spaghetti. After a few seconds, she dropped it, no doubt having concluded that it was not a red worm. The mystery of what looked like a mass of red worms, but was not, kept the bird silently thoughtful for a few seconds more. Then she tried again, and must have come to some kind of decision, because she picked up a good-sized strand and flew off, the spaghetti dangling from her beak.

After having been away long enough for a full-length conference to have taken place, she reappeared, sans spaghetti, but with two interested companions. The three of them now formed a half-circle around the pie-tin. They looked curiously at the strange dish before them, then began pecking somewhat hesitatingly at its contents. After sampling a full strand apiece, they flew off with definite enthusiasm.

Not twenty seconds had passed, when the three returned with five more recruits, including young birds. As they formed a complete circle around the pie-tin, like dancers in some strange ballet, there was once more that thoughtful, wondering pause. Then the first robin immediately plunged in, and strand after strand disappeared into her eager throat. After watching her for a few seconds, the others followed suit. The entire family seemed to be present, because no one left to go call anyone else. When the circle of robins finally stepped away from the pie-tin, it was as clean as it was ever going to be.

I may have been imagining it, but it seemed to me that when the robins prepared to fly home, their take-off was slower than usual. Although I am not a bird-watcher of any seriousness, I believe I am one of the few humans to have seen a group of robins lift their wings for home, with bellies full of spaghetti.





PHOTOGRAPH FROM THE HAYDEN PLANETARIUM, AMERICAN MUSEUM OF NATURAL HISTORY

The Willamette Meteorite at the Hayden Planetarium was once a sacred altar for Indians in what is now Oregon, was lost and then found again. It has an interesting history.

“A Piece of the Moon”

By JOSEPH C. CALLAN

IN a corridor at the Hayden Planetarium in New York City stands a massive chunk of iron-nickel, the Willamette Meteorite. It is a showpiece for visitors, who rub their hands along its smooth surface and exclaim over the deep ruts defacing the other side.

The ruts, some large enough to hold a child, are the meteorite's outstanding visual feature. If you are curious, you may ask about them. When you learn that they were dug out by rain, you may respectfully mumble something about the powers of erosion.

But if you inquire further, you may learn that the most interesting thing about the meteorite is not that it has deep gouges. In fact, its history is perhaps the strangest of any meteorite specimen.

It was found—and lost—and found again!

Exactly when this mass screamed out of space is not known. The only humans who might have seen it fall were the Clackamas Indians, who roamed the abundant forests of what is now Oregon. And long before the white man came, the Indians found the meteorite, perhaps pondered upon whence it came, and gave it a name.

They called it Tomanowos, the “medicine rock.” Whether or not they saw it plunge to earth they may be excused for believing, as they did, that it was “a piece of the moon.” At any rate, they assigned special and sacred powers to Tomanowos. They unearthed it and moved it to a small knoll amid pines and birches. And, although the “stone” weighed more than fifteen tons, the Indians took care to set it solidly with the rutted side exposed to the sky.

There in the forest the Clackamas hunted. Sometimes they were successful. Other times the hunt did not produce enough meat to carry the tribe through the long, cold Oregon winter without hunger. They needed powerful magic to guide their arrows to the mark, and they sought this magic in their rock from the sky.

Tomanowos stood majestically exposed to the weather, and when rain came the water was caught in the deep ruts. When this happened it was no longer simply rain; it was “holy water,” held fast in the cup-like confines of an altar. The rituals would begin then, the chanting, the dancing and the prayers. And as the medicine men

called upon their gods, the braves dipped their arrows into the sacred waters of the medicine rock.

Apparently, however, the magic of Tomanowos was not powerful enough, for, in time, the Clackamas dwindled in numbers and died out as a tribe. They abandoned their hunting grounds in the foothills of the Cascades and left their altar alone in the forest.

Rain-water beat on the earthen mound and undermined the meteorite. It toppled from its place and rolled into the underbrush. As the years passed, the trees grew again in the clearing, the brush covered the ground and the sacred stone was lost in the wilderness. It lay hidden there until 54 years ago. In the fall of 1902, Ellis Hughes, an Australian miner in search of gold, stubbed his toe on the meteorite, and set off a series of events that culminated in the specimen becoming the property of the American Museum of Natural History.

Although the metallic mass lay less than a mile from his run-down homestead, Hughes almost missed it, for it lay partially buried and almost completely hidden by the underbrush. From his experience in the mines, the Australian knew this was no ordinary rock. When he and a friend chipped off a sample, they knew they had not discovered gold, but believed that they had discovered a rich iron vein. They dug down a foot or two. The "vein" was even richer than they had dared hope! The assay office in Portland confirmed that the prospectors had, indeed, found iron. In fact, it was almost pure iron, but the kind that could be contained only in a meteorite.

This news sent Hughes' partner off for Alaska, where a man found gold, not fallen stars. But Hughes reasoned that a meteorite, a large one, must be worth something. It was. Later the American Museum paid \$20,600 for it; but not to the finder.

The meteorite was on property that Hughes did not

own, and there was a chance that someone else might make a claim to it when the find was announced. Then there was the matter of digging it up. After all, it weighed several tons, at least, and the only manpower at the miner's command was his fifteen-year-old son. He did have a horse, a small and ancient beast, already overworked. It might not be able to stand the strain.

In the end, Hughes decided to dig up his find, and, in secret, transport it from the forest to his own home, less than a mile away. There he could "discover" it all over again. The land, he had learned, belonged to the Oregon Iron and Steel Company.

Hughes first felled trees and fashioned a sturdy flatcar with large tree trunks for wheels. Then he devised a crude but efficient capstan. He dug out around the meteorite and lashed a wire rope to it. The other end of the rope he attached to the capstan, and with his horse tugging and turning round and round, Hughes managed to inch the meteorite out of its resting place, much as a sailor, with a similar device, lifts an anchor from the water.

The determined man toppled the mass on the wagon, and with himself, his son and his horse as motive power, he started home. Getting there, less than a mile away, required three months of back-straining toil. At last, however, they made it, failing to cover their trail. The company claimed the meteorite, now on Hughes' land. Hughes refused, and for a brief time enjoyed the lime-light, for scientist and citizen made pilgrimage to his back yard. Then, although he stubbornly fought the case through the courts, Hughes lost.

Like the Indians before him, he faded into history. His "vein of iron" is now the Willamette Meteorite, and few of the thousands of visitors who gaze at it yearly have any idea that they are looking at such an historic "piece of the moon."



AN ANCIENT SONG

*There is an urgency in the locusts' chirring,
As though they felt they'd slept a sleep too long.
This steady, loud and echoing, ancient song
Is borne upon an unquiet wind. They are stirring
In blind obedience to some natural law
That calls them forth from years of hibernation.*

*This does not seem to sound of jubilation—
This harsh and steady chirring from the maw
Of woodland, where the trees a hundred years
Have thrust their roots down into the loam
In search of food and water. On these roots
Have fed the locust horde. Now it appears,
And bearing its armor on its back. Its home
Behind, it rises to the light, salutes.*

Maron C. Ellenwood

This red-tailed hawk, so weak that it cannot stand, is being force-fed. However the medicine dropper contains an eye drug. The bird doctor advises that birds in a weakened condition should not be forced to take fluids, that a deep water dish be supplied, and foods be dipped in fluids such as milk, water or orange juice.



The Bird Doctor

By one who is one

PAUL H. FLUCK, M.D.

I HAVE TWO Doctor's Degrees. The first was presented to me twenty years ago at a graduation ceremony at the Academy of Music in Philadelphia. That diploma hangs on the wall of my office. It is printed on sheepskin and awes my medical patients into paying my fees. My other Doctor's Degree was presented to me by a blue-eyed, freckled child. That diploma was written in pencil on a scrap of notebook paper. It came wrapped around a box that contained a battered robin. It read:

"Dear Bird Doctor:

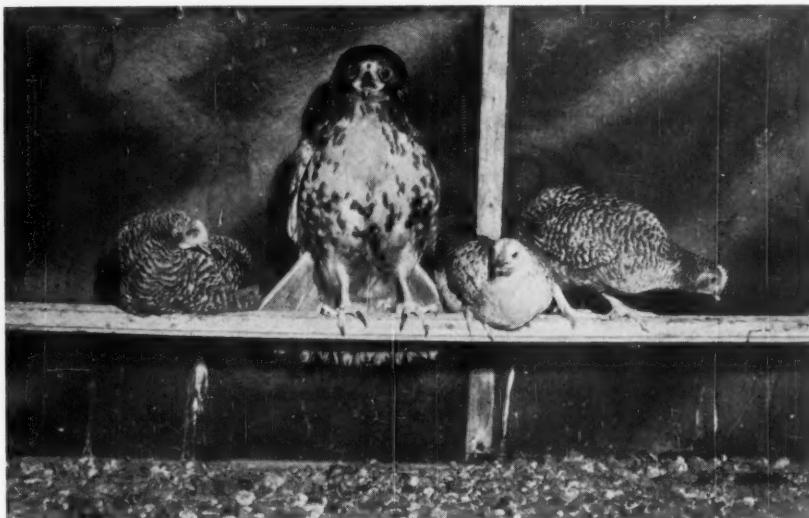
My robin is dying. Mother said you could save it if I brought it to you. Please do.

Carol."

I did save it. Carol's letter made me an *amateur* Bird Doctor. I waited almost ten years for another scrap of paper to make me a *professional*. It was a check for ten dollars, drawn on a bank in Hatboro, Pennsylvania. Written in the lower left corner were the words: "For the Care of One Sparrow Hawk."

It makes no difference that I never received another fee for such services. That check, duly cashed and listed on my income tax return, made me a *professional* Bird Doctor.

There are thousands of doctors, and all kinds of them, but I suspect there are fewer "paid" Bird Doctors, than any other physicians.



The red-tailed hawk being cared for above was put in a chicken coop with chickens for his convalescent period. The hawk killed all the mice and rats that came into the coop, but never harmed a chick or chicken. Later the bird was taken to Hawk Mountain and released.



PHOTOGRAPH BY NORMAN FISHER

Its foot caught in a piece of barbed wire nailed to a tree, this flicker fought off two German shepherd dogs for almost an hour. Both wings were almost torn off but the bird was slipped into a child's sock, finally recovered and flew away. Ants and oranges were its diet while it was recuperating.

Looking back now over ten years of aiding birds, I see that I had always intended to be a Bird Doctor. I knew it that first day, when I held a crippled bluejay, her bill completely snipped off by the washing-machine motor. Holding the bird in my hand, I dashed to my medical kit for a piece of oxidized cellulose to stop the bleeding. I held the cellulose over her bloody face for almost half an hour, while the phone jangled in vain with calls from my human patients. When the bleeding stopped, I snipped off most of the cottony stuff and looked hopelessly at my patient. The bird's eyes sparkled behind the bloody clot, and her tiny tongue flicked in and out, in pain. I considered putting the jay in a box with some chloroform on cotton. But my wife said "No."

I said, "How will she eat?"

My wife said, "We'll see about that when the time comes."

When the time came, my wife chewed up food, and the bird picked it from between my wife's lips. For three weeks the bird ate everything in that way. Then she began to eat mashed potatoes and milk by herself, and finally her bill grew back far enough to cover her tongue.

While the jay was getting well her recovery was making news, and the door-bell was ringing. Children were bringing in crippled grackles, robins and sparrows. A policeman brought in a heron and a duck, and I was finding injured birds along the highway and in the park. The bird doctor business was booming. Birds were in boxes, in cages, in the bathroom, and in closets. If I had stopped to look ahead, I would have seen the impossibility of keeping up with the crippled bird business.

For humans a ratio of one doctor for every seven hundred patients is about average. But there are said to be seven billion birds in these United States, and I was the only practicing Bird Doctor in the Delaware River Valley.

Besides being the lowest-paid profession in the world, bird-doctoring is the most demanding, physically. I have carried a flicker around from ant hill to ant hill for hours on a hot August day when the thermometer stood at 100. I have chased grasshoppers and leaf-hoppers during July, August and September to feed a kingbird, and a scarlet tanager. For fifteen months I drove eight miles every day to stuff a pound of perfectly good beef liver down the throat of a blind barn owl, which never hunted a mouthful for himself all the time he was in my care. After the owl passed on, a rowdy red-shouldered hawk took his place, and for a year I drove the same eight miles to stuff more fifty-cent-a-pound beef liver down his throat. Every day I came home with blood oozing from my hands, and many evenings in my office I could not give a hypodermic injection with my bandaged fingers.

But bird-doctoring pays off in a big way. If you have the stamina to take it, and enough closets, and bird cages, and bathrooms, and back porches to house them, birds make the best patients on earth. They never complain. They never hire lawyers to sue you. They never sign hospital releases and go home. And while it is true that a get-well rate of 50 percent is hardly ever obtainable, you can be sure that you will spend some of the most interesting hours of your life when bird-doctoring.



PHOTOGRAPH BY NORMAN FISHER

Barney, the blind barn owl, loved both attention and affection. The bird doctor had to feed him by hand daily for fifteen months.

I feel sorry for people who have unintelligent parakeets and canaries for pets. These have been reared in captivity and deprived of the urge to be free. Wild birds are part of Nature. Many flow north with the spring and south in the fall as unhinderable as water pouring over a waterfall. They roost, eat, fight, drink, sing, bathe, and scheme escapes. Some of the most unforgettable hours of my life I have spent with a red-tailed hawk on my arm. The most affectionate friend I ever had was a bluejay. The most beautiful thing I ever had in my hand was a bluebird dying of footpox. If I sound like I am a bit soft in my head, mull this over in your own. Barney, the blind barn owl who lived in the old house in Washington Crossing Park, drew crowds of hundreds of people every Saturday and Sunday afternoon. Many drove more than a hundred miles to just stroke the feathers on his ugly head for a few seconds. In those fifteen months Barney did a job for conservation. His fans came in sleet, snow, fair weather, and during the terrible Delaware Valley Flood of August, 1955. Barney appeared on TV, and he got fan mail. Some real tears are shed when I tell visitors that the owl died on Halloween.

Actually, here and now, *and with emphasis*, let me make it clear that bird-doctoring is a ninety percent unnecessary profession. Most small birds with broken wings make out far better if they are left to fend for themselves in a thicket of honeysuckle or blackberry briars near a spring or a brook. I have cold-heartedly released as many as a dozen birds that could not fly from wing injuries, in snow and sleet, in such locations. And in six instances I have recaptured those birds again. The bands on their legs proved that they were the cripples—completely recovered!

One song sparrow flew weakly from my hand and collapsed under a spice bush. I worried about it all night. At dawn I got up and spread enough bird seed around that bush to feed a hundred canaries. I did not see that bird again, for two years, and blamed myself for letting him go in the snow. Then one day I picked him out of a bird trap, and read his band. I thought I was seeing things. I read the number over again, and had two friends read the number. That little scamp came back every day for a month or so. He had so much zip that I could not handle him. I still think that on that first afternoon he was playing "possum," and that if I had kept him overnight he would have died!

Again I say, the best thing for an untrained bird doctor, and that probably means you, to do with a bird that cannot fly is to let it go at once, in the safest place you can find.

Most of the bird patients I have treated have been spe-



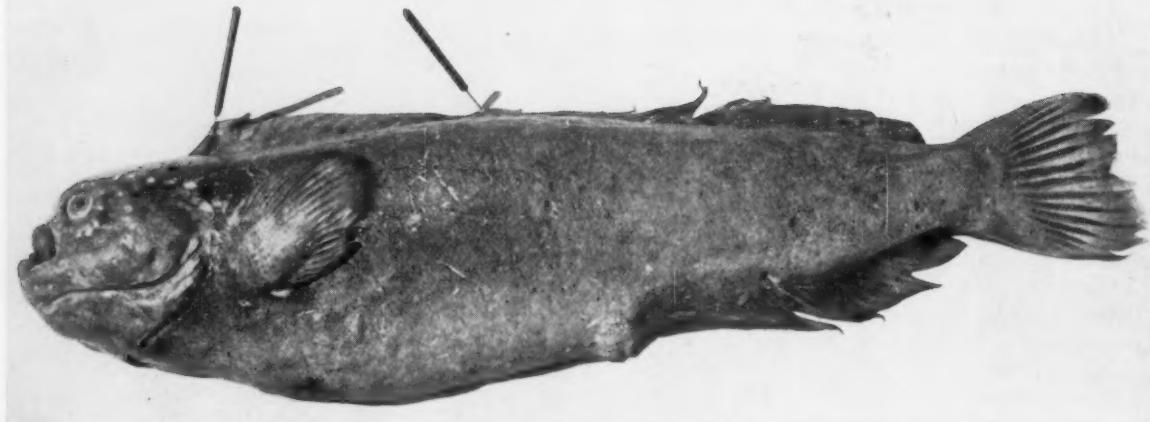
PHOTOGRAPH BY NORMAN FISHER

Barney, although he could not see his admirers, enjoyed the center of the stage. More than 15,000 visitors to Washington Crossing Park's bird program stroked the owl's feathers during his fifteen months at this park. Here is a typical Sunday crowd at the program.

cial patients, large birds like hawks and owls; blind birds; birds with hemorrhages, birds with diseases that might have infected wild birds. It made no difference how hopeless the case looked, I treated every bird exactly as I would have treated a human patient. Then I put the bird in a dark closet, except for owls, which I place in a lighted closet, and I wait twelve hours, or as much as twenty-four. Then I can predict the outcome. Dead birds are buried, or given to a taxidermist to mount. Live birds are treated exactly the same as well birds. Just as it is with chronic patients among people, birds that can never get well, or never care for themselves again, are the most difficult problems. But there is a place even for them.

At the bird programs at Washington Crossing Park my crippled birds pinch-hit for me on days when birds refuse to go into banding traps, or when rain or sub-zero weather makes banding too uncomfortable. From the reaction of the 35,000 people who have come to the bird programs in the Park in the last four years, I am sure that many like the crippled birds best.

Peanut, the scarlet tanager, will never fly again, but he can drink Coca Cola from a straw! Rosie, my helpless rose-breasted grosbeak, has posed for more Kodachromes than any grosbeak on earth. Saucy, my eleven-year-old bluejay with the deformed bill can dance like a strutter at the Mardi Gras. Unlike too many chronic human patients, birds do not give up. They keep on trying to get well. They keep on learning (*continued on page 332*)



The "highbrow fish" of north Pacific waters is not frequently found but may not be rare. It is thought that its habits make it a sort of marine equivalent of the mole.

"Highbrow" of the Deeps

— By ROBERT HERTZLER

AN ODD fish with a bulging forehead and no known relatives, lives in the coastal waters of the Pacific, from Oregon to northwestern Alaska. Known to science as *Zaproras silenus*, this fish, because of its "brainy" appearance, has been called the "highbrow fish." This popular name is, perhaps, fitting since the species is in a class by itself.

The first recorded specimens were taken in November, 1895, from the deep harbor of Nanaimo, British Columbia, a port on the east coast of Vancouver Island. Two specimens were obtained, the largest of which was twenty-nine inches long. An attempt was made by a local taxidermist to stuff the larger, but eventually the two fish, safely preserved, found their way to the Provincial Museum in Victoria.

There David Starr Jordan, the great naturalist and educator who then was president of Stanford University, came across them in 1896 and described and named the species. After considering it as related to other fish genera, he finally concluded that the homely highbrow represented a lost limb in the family tree of fishes.

Lost or not, *Zaproras* was certainly hard to find. In all the years between 1896 and 1930 only eleven additional specimens came to light. Then, between May, 1930, and June, 1932, the International Fisheries Commission investigated the food resources of the North Pacific halibut grounds, and, in the process, made 2500 plankton hauls at depths ranging from sixteen down to 195 fathoms. In those 2500 hauls, thirty-six specimens of *Zaproras* from one-half to three inches in length were taken. Scientists at institutions in the United States, Canada and Great Britain studied these specimens and decided that the highbrow was an isolated branch of

the *Perciform* type, but was specialized and quite different in many ways.

Since the fisheries survey, occasional specimens have been taken by commercial fishermen. A twenty-five-inch highbrow was brought up from a depth of 405 fathoms off Newport, Oregon, in 1945, and in 1949 the specimen shown in the accompanying photograph was taken on Umatilla Bank off the Oregon Coast at a depth of forty fathoms.

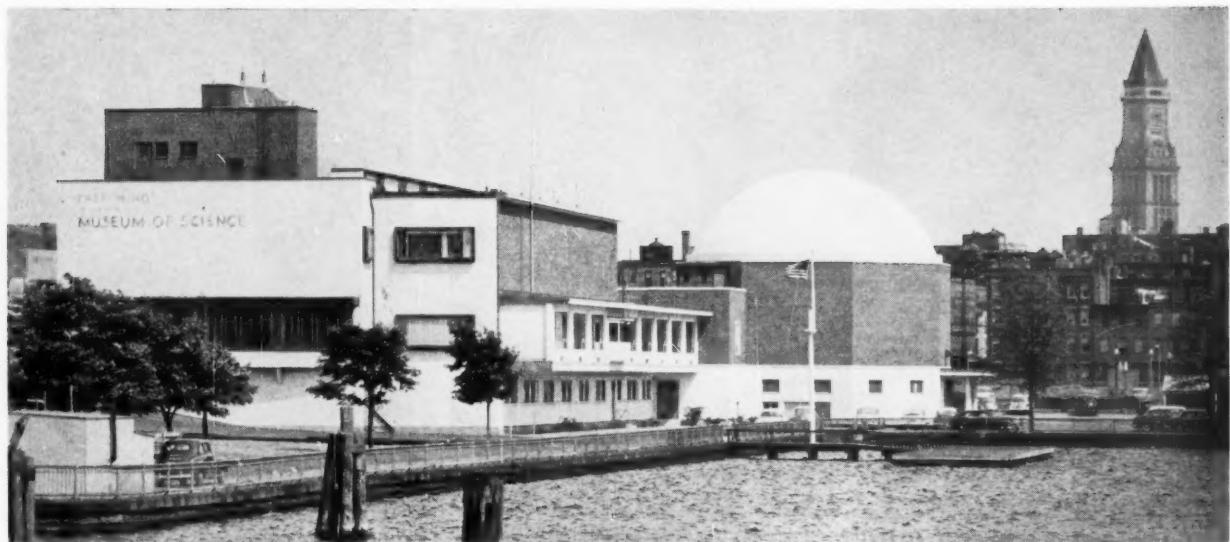
The most noteworthy physical characteristic of *Zaproras* is a series of about sixty large pores arranged symmetrically on its head. The pores secrete a clear, viscous fluid from which the fish derives its unflattering scientific name. Dr. Jordan named it for a perpetually drunken demigod of Greek mythology, who, because of his over-indulgence was, as the scientist phrased it, "covered with slime."

The coloration of the highbrow fish is quite uniform over its entire body, and varies from reddish-brown to dark brown, depending on the area where it lives. The body is stout and compressed, giving the fish a robust appearance. Its flesh is firm and its skeleton rather limp and flexible, a fact which has led some ichthyologists to refer to it as "the flaccid fish."

The fish has a dorsal fin that extends almost the entire length of its body. Its pectoral fins are heavy and well-developed. The anal fin is short, and there is a complete absence of pelvic fins. The lateral line also is lacking in *Zaproras*.

The profile of this fish's head is distinguished by the high blunt snout and forehead, which Jordan described as being "broad and abruptly convex." The lower jaw of the fish is heavy and it pro-

(continued on page 332)



Here is the Boston Museum of Science from the Charles River, showing the dome of the Planetarium and the wharf. One settlement house leader in a high juvenile delinquency area says this of the Museum: "Often a delinquent is a delinquent because he is looking for something new or some excitement. The Museum offers constructive excitement which can compete successfully with undesirable attractions."

Boston's Lively Museum

By ALDEN S. WOOD

THE used to be an old vaudeville "saw" that people went into museums only to get out of the rain. People still may scuttle through museum doors during a sudden shower, but chances are they will remain long after the sun has come out, for, during recent years, museums have changed.

Pointing up this bright, new trend of dramatization, animation, and participation is Boston's Museum of Science, located in Science Park. A 1951 outgrowth of the Hub city's Natural History Museum, this newcomer, with its modern buildings, enthusiastic young staff, and diversity of exhibits, today enjoys the greatest visitor-density of any museum in America.

Considerably more than a million people have strolled across its broad floors, operating the many push-button exhibits, peering into the deceptive dioramas, and handling live animals like "Spooky," the great horned owl, "Herkemiah," the porcupine, or "Black Beauty," the friendly Florida indigo snake. They can "see"

sound, operate a model atomic pile (which the Atomic Energy Commission said is the best of its type in the country), inspect a turbo-jet aircraft engine, and watch a snake merry-go-round.

The Museum does not just sit and wait for visitors to come—it offers a variety of clubs, science courses, television and radio programs, and an unusual science information service. This last provides, via letter or telephone, the answer to any question related to science. These have ranged from how to dislodge (without injury

Part of a typical Sunday crowd waiting for the east wing doors to open. Since its beginning in 1951, the Museum has welcomed more than a million visitors.

to either party) a skunk from beneath a porch to how to care for the two-foot alligator a local man found roaming high and dry in the woods.

When the Museum opened its doors, it shocked staid Boston with something quite unprecedented. It charged admission fees—forty cents for adults, twenty cents for children under 13. Many people hastened to predict an early demise. During 1952-53, 200,000 people came, and went home to tell their friends. During





The Museum's "Road Troupe," reading from left to right, are "Black Beauty" a Florida indigo snake; "Spooky," a now famous great-horned owl; "Herkemiah," a porcupine. The photograph is of a quite young "Spooky." This trio has logged thousands of lecture miles and made many friends.

1954, nearly 260,000 people visited the Museum, more than 34,000 attended weekend film programs and visited the library, and more than 680 enrolled in the seven science courses. Soon the skeptics were laying down their forty cents to see just what it was this bold, young neophyte had to offer. After viewing the hundreds of exhibits and demonstrations, bending a railroad rail with a bare hand, hearing their own telephone voice, or working the sand pendulum, they understood.

Says Bradford Washburn, the Museum's dynamic director: "Continuous education of our youngsters and re-education of ourselves is necessary today for public understanding of the rapid advances of the sciences. Our educational approach here at the Museum of Science aims, first, to stimulate curiosity and interest in Nature and Science through lively exhibits and demonstrations; and, second, to encourage and help the individual, of whatever age, to follow up those interests." ♦♦♦

Invalided youngsters, who cannot hope to see "Spooky" and his kind in native woodland haunts, visit the owl at the museum. The bird fell from a nest when a hootless ball of fluff, was brought to the museum and grew up there.

Grounded during a hurricane, this hummingbird was brought to the museum, became tame and learned to take lunch of sweetened milk on the wing until strong enough to leave.



"Spooky" glowers at the camera. He has traveled more than 5000 miles, visiting schools, camps and hospitals and has appeared on Dave Garroway's TV show from New York.



It is really difficult to believe that Mount Washington, towering behind this dioramic family of black bears, is only six feet away from the observer. Superlative taxidermy on the animals themselves has more than once prompted visitors to whisper, "Are they real?"



Noted Nature painter Francis Lee Jaques works from a "study skin" of an actual bird in preparing the Shore Birds Habitat Group diorama. (Below) Boys' Clubbers rally around Rosy, a de-commissioned skunk. The Museum plays host to countless woodland waifs that are picked up by sympathetic folks. These animals are fed, cared-for, and, when practical, released at maturity.



Many thousands have touched friendly "Black Beauty," and learned she feels cool, clean and like patent leather. Below, "Herky," busy with an ear of corn, has taught young folks that porcupines do not "throw" their quills. He likes to be held.



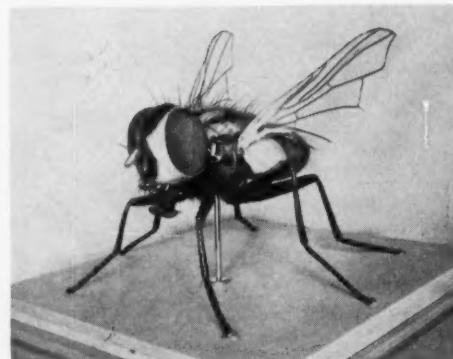
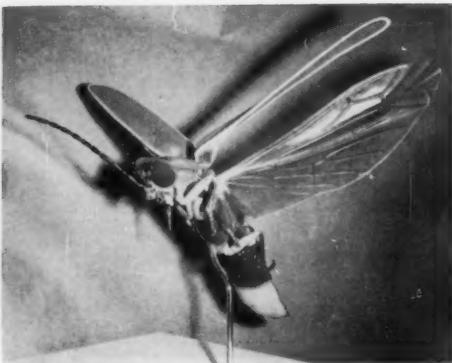
A DROP OF WATER



Magnified 250 times, this drop of pond water reveals the teeming microscopic life the naked eye cannot see. Central figure is a budding hydra. It is surrounded by diatoms, desmids, algae, and other forms of minute life.



Hanging upside down, this eastern black widow spider (left) is a model 25 times life size. The viewer may press a button and see an actual black widow in a special case. At the right, 250,000 times life size, is a female swamp mosquito. At the left, below, is a flashing firefly, 265,000 times life size. A push-button operates his tail light. It is really, of course, a beetle. At the right is a common housefly, enlarged 260,000 times. This exhibit was ten months in the making. Two feet long, the model has a wing span of 27 inches. Its creator, Chris Olsen of Nyack, New York, set 14,000 separate bristles in the fly's body. The creature is made of wax and plastic.





Two young students study the sprawling growth-rings, now dotted with push-button identification lights, of the three-ton cross-section of sequoia log. The slab, 2048 years old, shows a great fire scar in its upper right-hand corner. Notice how the tree had begun to close in the damaged portion to prevent decay or further injury.



"Spooky," tame great horned owl, shows off his wingspread for noted writer-naturalist, John Kieran, during recent 73rd Stated Meeting of the American Ornithologists' Union at the Museum. Looking on is Gilbert Merrill of the Science Park Education Department.



Education Department director Norman D. Harris and his wife, Joan, a former biology major, are shown here as they appeared on the Museum of Science TV show, "Wonder World," with boa constrictors, from A to Z.



Nature Babies

A Photo-Quiz

By DOROTHY M. COMPTON

BABIES always have a special appeal and this is not confined to human babies. The young of birds and mammals are always interesting. On these pages are pictures of a dozen wild babies. Can you identify them all? See page 332 for the correct answers.

←

1. A hand-raised-..... on his first adventure at tree-climbing.



2. A tired baby dozes under some larkspur in the garden.



3. A coy young inspects a luncheon of raw meat before partaking.



4. A fall baby prefers a tidbit of tomato to a dessert of nuts.



5. This forlorn little seems to be asking the question, "Where's my mamma?"



6. Bristling all over, this young defies his discoverers.

←



7. This young is soft and fluffy at this age.



8. These two young have had numbered leg bands put on their legs to trace their travels.



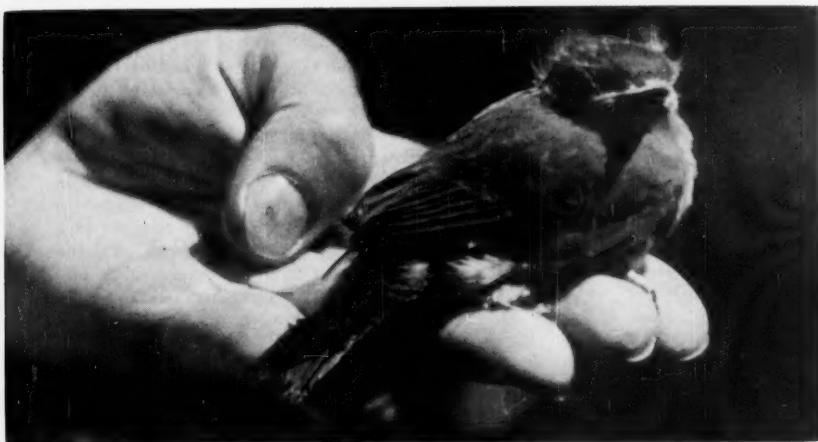
9. This young is ready and eager for a handout and will be even more so when it grows up.



10. This baby is well camouflaged by its feathers as it crouches on the ground.



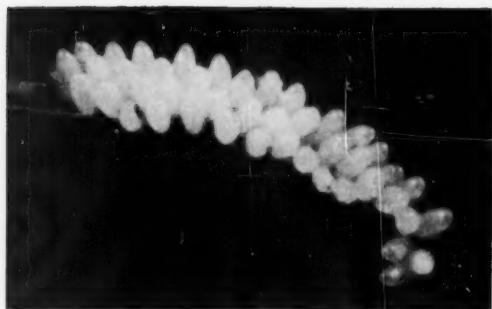
11. Two young show their independence as they prepare to leave their nest.



12. This young was found in a nest in the cellar of a deserted house. It still has tufts of its baby down showing.



This common ladybird beetle, *Hippodamia convergens*, is readily found on plants infested with plant lice. It is orange red in color with black polka dots on its back. It goes through its complete life cycle from egg to adult in a period of about a month.



Tiny yellow to orange colored eggs are laid in clusters on plant stems and leaves infested with aphids, or plant lice, 44 eggs being found closely arranged on this weed stem.

Ladybird Beetle

ONE of the best-loved insects is probably the brightly colored ladybird beetle. These beetles are welcome residents in our gardens, where they are always busy clearing plants and trees of such common pests as plant lice and scale insects.

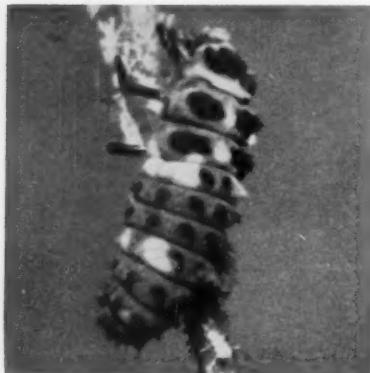
The larvae of ladybirds are especially helpful in the destruction of insect pests. Looking more like tiny dragons than insects, they consume huge quantities of plant lice while they are growing up.

When disturbed a ladybird will frequently fold up its legs and roll over on its back as if it were dead. For a few minutes it will "play possum." Then it will sud-

denly extend its legs, flip over into an upright position, and run away. When taken captive it will give off a disagreeable fluid. It is thought that birds pass it by for this reason.

About two thousand species of ladybird beetles are known, all except a few being beneficial. They are found in a great variety of colors and spotted patterns. Some have stripes instead of spots, and a few have no markings at all.

The complete life cycle of a common red species with black spots, known as the convergent ladybird beetle, is shown in the close-up photographs. ♀ ♀ ♀



1



2



3



4



5

Close-up of the ladybird larva (1) shows that it has three pairs of stubby legs, a segmented body with six warts on each segment. It is busy eating plant lice. After shedding its skin several times, the larva (2) is about one-quarter-inch long and ready for the pupal stage (3). It attaches to a leaf, moves back and forth until the outer skin splits down the back and the chrysalis appears (4). When touched the chrysalis snaps up and down at the hinge-like arrangement at its point of attachment. After a few days the adult emerges (5), the beetle pale yellow, spots invisible and wings crumpled. Gradually it darkens, spots appear and wings harden.



National Park Prize Poems

To focus attention upon and arouse appreciation of our National Parks, Mrs. Charles Cyrus Marshall, President and Founder of the National Life Conservation Society, announced a prize contest for poems devoted to these great areas. Many excellent poems were submitted, the judges finally awarding first prize of \$100 to Florence Burrill Jacobs of Skowhegan, Maine, who appropriately wrote of Maine's National Park, Acadia. The second prize of \$50 went to Roland English Hartley of Santa Fe, New Mexico. To Charles B. Shaw of Swarthmore, Pennsylvania, went the third prize of \$20. Because of the fine message of these poems we present all three here this month on the page usually devoted to our editorial comments on conservation issues. These poems are specially timely as "Mission 66" turns our attention to the future of the great system of National Parks.

ACADIA NATIONAL PARK

*This island off the spruce-dark coast of Maine
Is sanctuary. Through the tamarack,
The twisted cedars and the rough gray boulders,
Take a long curving road up Cadillac;
Look over Frenchman's Bay, deep as Maine skies
In March, watch lacy surf break on a shoal
Eaten from red rock; hear the vibrant, hollow
Boom of the Thunder Hole.*

*(Do not forget the ghosts who walk these woods:
Champlain on his way to Quebec one summer
Three centuries ago, the Sieur de Monts,
Sir Francis Bernard . . . Each of them newcomer
Beside the lean brown Abenaki tribesmen,
With their good friends, familiars of these rocks,
Shy deer and caribou, the fierce bald eagle,
Arrogant tawny fox.)*

*But centuries are short and history only
A passing land-mist over what was here
From the beginning, what will still remain:
Rugged, secure, year after timeless year:
The otters which have always owned the cliffs,
The granite mountains rising wild and free
And elemental as they stood forever,
The everlasting sea.*

Florence Burrill Jacobs

OUR NATIONAL PARKS

*Even the names can stir us — Yellowstone,
Grand Canyon, and Yosemite. They all
Are one in meaning beauty made our own.
Oh, how the names recall the white-foam fall
Of waters and the skyward thrust of trees,
The rival palettes of the rocks and sky!
What can we do in gratitude for these?
Creation is not man's to magnify.
All that we have to give is reverent praise.
But we are pygmies with a giant's might.
We can tear down what centuries have built
And revel in the ruin of our days.
Oh, let us come to beauty with delight
And answer with devotion, not with guilt.*

Roland English Hartley

OUR HERITAGE

*Acadia, Grand Canyon, Everglade,
Great Smokies, Shenandoah, Yellowstone—
Transcendent, in their splendor, stand arrayed
The woods, the fields, the cave, the mountain cone:
Sequoia, Carlsbad, Zion, Crater Lake,
Yosemite — a storied, gloried roll
Of names and refuges and scenes, to make
A folk exuberant and proud in soul.*

*Where Clark and Lewis pioneered among
Pacific groves, in Osceola's haunt —
For North and South and East and West, a tongue
Of angels might mellifluously vaunt:
"These are your heritage; your legacies
Of priceless and incalculable worth;
These comely hills, these rocks, these towering trees,
These limpid streams, these lakes, this fruitful earth."*

*From little men (the buckster and the sport;
The avaricious, killing, careless caste
Of men on lucre long, on conscience short)
With greedy wish, to ravish and to blast,
We must protect — that they shall not purloin
Our splendid heritage of sky and soil:
For that which God so lovingly did join
Let not man rend asunder and despoil.*

Charles B. Shaw



History, scenery and near-wilderness along the Chesapeake and Ohio Canal combine to provide a tranquil sanctuary for dwellers in the Washington area and the nation.

Locks, lock houses and other canal structures have been restored under National Park Service direction.



*National attention focuses
on the question—*

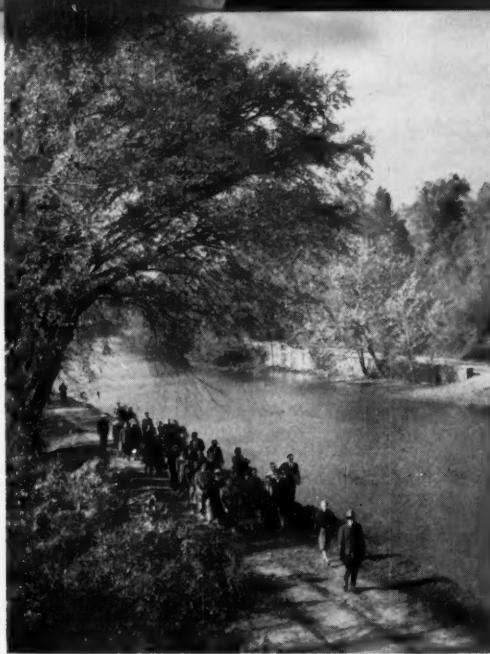
Where Goes the C. & O.?

By BIL GILBERT

*Photographs by William Beanland
and National Park Service*

THE Chesapeake and Ohio Canal is a thin ribbon laced up the Potomac valley from Washington to Cumberland, Maryland, 185 miles to the northwest. The waterway, hugging the river, climbs up from tide-water through the rugged Potomac gorges and eventually into the Catoctin Mountains.

During its period of commercial operation, 1850-1924, the canal was beset by innumerable financial crises, fierce competition from the railroad, and "rebellion" by disgruntled Irishmen, who had been indentured to complete the man-killing job, to say nothing of such natural disasters as floods, cave-ins, and landslides. Today, as a "hot potato" property of the National Park Service, the canal remains true to its turbulent history, for the fate of this strip of wild-wooded waterway has been a subject of bitter controversy among conservationists, the Park Service, road builders and various other repre-



The Canal towpath is trod by many groups that take part in the Nature walks provided by the interpretive service of the National Park Service. A barge, *The Canal Clipper*, makes trips during the season.

sentatives of local, State and Federal agencies.

However, peace may be coming to the canal. A recent reappraisal of the entire canal controversy by the Park Service has resulted in a decision that the area should be set aside as an historic section where Nature and recreational values will be protected. This report, made public early in 1956, is a signal victory for conservationists, who have fought against the use of the old canal as the route of a new highway. They have argued vigorously that the historic semi-wilderness of the waterway is one of the most pleasant outdoor areas in the populous middle-Atlantic area, and that road building along or on the canal bed would completely spoil the natural and historic features. With the Park Service, reversing itself on earlier road building proposals, now agreeing with these private conservation groups, it seems likely that the Chesapeake and Ohio Canal, a strife center for more than a century, will at last find the tranquil, protected and useful niche that its defenders claim that it deserves.

Blasted through the Potomac cliffs at a cost of \$60,000 a mile during the 1828-50 period, the long waterway had only about two decades, from its opening until 1870, of real economic value. Even during this period water traffic was halted for nearly five years during the War Between the States as Union and Confederate raiders repeatedly cut the transportation route. Although abandoned as an economic failure in 1924, the canal right-of-way remained rich in history, scenery and wildlife. Many thought that the strip might be turned into a unique public recreation area. In 1930 Congress passed the Capper-Crampton Act, which enabled the National Park Service to begin purchasing canal lands. By 1938 the Service owned the entire 185 mile right-of-way.

For development purposes the legislative acts divided the canal into two sections. The first was a seventeen-



The Canal today is a favorite spot for canoeists, hikers and naturalists. Lock No. 6, less than a mile from the District of Columbia line, overlooks a scene retaining much of its 19th century character.

mile segment from Washington, to the spectacular Great Falls of the Potomac. The second was made up of the remaining 168-mile canal strip from Great Falls to Cumberland.

The Park Service set about rehabilitating the lower section, that nearest to Washington, soon after taking control of the area in 1938. Old levees, locks and lock houses were repaired and water readmitted to a 22-mile section. The towpath was cleared and filled. Access roads, picnic and camping facilities were provided. This section has been developed as a sort of wild city park, and forms a valuable adjunct to the recreation system of

Supreme Court Justice Douglas (pointing) and two of his fellow hikers on the Canal discuss something with one of the park policemen.





Motorized craft are excluded from the Canal, but it is popular for canoeing and camping along the route.

the Washington metropolitan area. The Service has also had plans for road building in this close-in suburban section of the canal and, while civic and conservation groups are willing to go along with this itself, they object to the proposals to locate it directly through the middle of the woody canal park. They argue that adjacent higher ground would offer a more scenic parkway route, and, at the same time, would save the secluded canal for those city dwellers who like their recreation automobileless. Recent indications are that the Park Service is willing to compromise and to route at least a major portion of the parkway along the bluffs, thus protecting the canal-park.

Although the "suburban" section of the canal has important recreational values, it was the second, longer and much wilder segment of the waterway, from Great Falls to Cumberland, that particularly attracted conservationists. Here the Park Service has kept the towpath cleared and made necessary repairs to certain of the historic canal structures, but by and large had allowed honeysuckle, sycamore, cat brier and assorted wildlife to take over the right-of-way, turning it into a formidable wilderness just a few miles removed from the national capital.

By 1945, the Park Service restoration and protection project created a unique scenic and recreational area at Washington's backdoor. The entire 185 miles of towpath is one of the most delightful hiking and cycling trails in the east; wild and undeveloped enough for serious hikers and campers but easy and accessible enough to encourage the casual, less athletic Sunday afternoon stroller. The twenty-two miles that have been refilled with water (from which all motor craft are excluded) are equally enjoyed by the contemplative canoeist and the young Huck Finns poling along on log rafts.

Deer, fox, woodchuck, raccoon, skunk and most of the other small eastern mammals are found in the tangled, protected right-of-way wilderness. Ornithology students, professional and amateur, including Roger Tory Peterson, who, for a number of years, made his home on a site overlooking the canal, find that the sheltered, well-covered canal cut is a remarkably good area for the field study of middle-Atlantic species.

The careful restoration of many of the historic canal

Above Great Falls the Canal bed was blasted from overhanging gneiss formation. The waterway cost \$60,000 a mile to build at a time when a dollar was worth far more than it is today.



structures has also added greatly to the over-all charm of the secluded waterway. As one observer commented: "One walks backward along the canal, backward into the nineteenth century."

Shortly after World War II the Park Service began seriously to discuss plans for developing the upper canal. In 1948, Congress authorized a "reconnaissance survey of the Chesapeake and Ohio Canal between Great Falls and Cumberland, Maryland, and to report to the Congress upon the advisability and practicality of construction thereon of a parkway and for other purposes."

The reconnaissance was carried out by representatives of the National Park Service and the Bureau of Public

Roads. When the survey was published, several years later, shocked conservationists were certain that the road builders must have dominated the group. It seemed that the fact-finding group had ignored Congressional instructions and had concentrated on proving that a parkway could be built, rather than determining whether or not such a highway should be built. The Report (House Document No. 687) brushed aside non-parkway uses of the canal in the first few pages. The bulk of the 87-page document was devoted to advocacy of a parkway built directly along the canal and in some places actually on top of and obliterating the old waterway.

Perhaps the most effective and influential critic of the survey was one of America's outstanding outdoorsmen, Supreme Court Justice William O. Douglas, whose adventures in remote regions have won national admiration.

On January 3, 1954, *The Washington Post*, one of the nation's most influential newspapers, editorially supported the Park Service plan for highwayizing the upper canal. Several weeks later the *Post* printed, in its "Letters to the Editor" section, Justice Douglas' now famous defense of the canal. The Douglas letter read in part: "The discussion concerning the construction of a parkway along the Chesapeake and Ohio canal arouses many people. Fishermen, hunters, hikers, campers, ornithologists, and others who like to get acquainted with nature first hand on their own are opposed to making a highway out of this sanctuary."

"I wish the man who wrote your editorial of January 3, 1954, approving the parkway would take time off and come with me. We would go with packs on our backs and walk the 185 miles to Cumberland. I feel that if your editor did, he would return a new man and use the power of your great editorial page to help keep this sanctuary untouched."

"One who walked the canal its full length could plead that cause with the eloquence of a John Muir. He would get to know muskrats and fox; he would hear the roar of the wind in the thickets; he would see strange islands and promontories through the fantasy of fog; he would discover the glory there is in the first flower of spring, the glory there is even in a blade of grass; the whistling wings of ducks would make silence have new values for him. Certain it is that he would never acquire that understanding going 60 or even 25 miles an hour."

The *Post* editors accepted Douglas' challenge to walk the canal. In the spring of 1954 an expedition which, in addition to the principals, included reporters, photographers, sportsmen, naturalists, historians and federal officials hiked along the towpath from Cumberland to Washington. The hike of Justice Douglas, and his for the most part footsore colleagues, focused both local and national attention on the canal and the question of whether in the future it should be for the hiker or the motorist. Various private conservation groups, interested in the preservation of the natural and historic features of the Potomac Valley, found considerable public support in their opposition to the proposed highway. This opposition was expressed through individual letters,



There is considerable variation in terrain as the C. and O. Canal climbs from tidewater to piedmont. Here it winds past fern-draped cliffs into wooded, rolling Maryland farm country.

petitions, and direct personal appeals to members of Congress and Park Service officials.

With increasing signs of public dissatisfaction with the road-building plan, Federal officials began to re-examine their parkway report. In January, 1955, Conrad Wirth, Director of the National Park Service, appointed a second group headed by Ben H. Thompson, Chief of the Park Service's Division of Cooperative Activities, to re-study the entire upper canal program. Thompson and his colleagues subscribed to a modified version of the Justice Douglas approach, that is, the only way to know an area is to study it at first hand. Thompson and his committee spent a number of pleasant spring and summer days during 1955 examining the canal right-of-way, on foot, by jeep, and from the air.

After studying the Thompson report, Mr. Wirth, in December, 1955, sent a memorandum to the Secretary of Interior that in effect reversed the Park Service's plan for development of the canal. The first and most significant section of this four-point memorandum stated: "The canal structure as a whole should be preserved as a Federal project for its historic and recreation significance. A road should not be built on it."

The memorandum suggested that certain additional access roads should be built into the canal lands to allow for easier public entrance into the sanctuary; that restoration of certain deteriorating canal structures be begun immediately and that the canal area from Seneca to Cumberland be joined with the (continued on page 330)



"Zipper"— A Long-tailed Weasel

By LLOYD P. PARRATT

Photographs by the Author

At first Zipper took condensed milk from a baby doll bottle. But he soon bit the end off the nipple and enjoyed getting lots of milk both in his mouth and all over his face like a little pig. Soon he was eating ground beef with great gusto and was no longer interested in milk. Zipper had a large appetite for such a small animal, weighing three and a half ounces at this time.

Two weeks after finding the weasel, he had become very active, spending much time chasing his tail. He developed a beautiful buff color on the underside of the body and his weight was up to five and a half ounces.

Zipper liked fish best of all foods. He made a ritual of biting me every day so I used gloves to handle him. But he became difficult to weigh as he pushed out the top of the plastic weighing tube. In one two-day period he ate two white-footed mice and had a great time catching and eating them. These mice weighed nearly one ounce or about one-sixth the weight of the weasel. His crowning act of gluttony was eating two white-footed mice, or one-third his weight, in a single day.

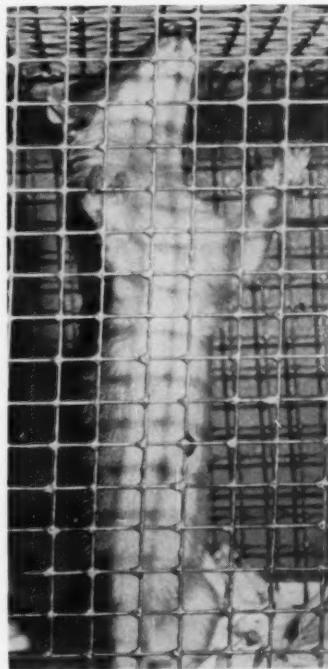
On the twentieth day we decided Zipper was mature enough to fend for himself under natural conditions. Upon release he immediately set up housekeeping under our cabin, with an entrance near the opening that aerated our underground cooler. One time the weasel got a large fish head and the family enjoyed watching the amusing antics employed to get the head through a hole not quite large enough.

A few days later the boys saw the weasel in hot pursuit of a large Columbian ground squirrel. The squirrel darted into a hole, followed by the weasel and we do not know what happened to the squirrel.

About this time my wife, Grace, began to complain about the strong fish odor under the cabin, so we plugged up the entrance while the weasel was outside. He finally left, after going through all sorts of gymnastics

(continued on page 330)

Above, the baby long-tailed weasel, *Mustela frenata*, soon after being found. Below, Zipper calls for food. Note his buff underside.



IN EARLY July, 1955, while on duty as Naturalist at Sun Point Information Station, on the shores of Lake St. Mary in Glacier National Park, a man rushed in saying, "Ranger, I hit a family of weasel-like animals driving to the Rising Sun cabins last night."

A fellow naturalist relieved me from duty while we went out to look for the animals. Two dead young weasels, out of the described litter of five, and the adult female were located after considerable search. The visitor was positive that one or two young had survived. Further search revealed one of these alive. Although it could hardly crawl, it snarled and bit until we placed it in a box with the body of the female.

This happened on the Going-to-the-Sun Highway near the east end of Lake St. Mary on the east side of the Continental Divide at about 4500 feet elevation.

The baby weasel was too young to survive unless cared for, so we decided to raise it by hand. We took some pictures of the young weasel and began a schedule of observation, weighing and measuring. From length and weight we decided it was a male. The weasel soon became active and climbed all over the cage. It called for food with a nasal grunt-like or barking call, sounding like "zip," so we called it Zipper. Sometimes he would squeal with rage when not fed to his satisfaction.

Acorns Tops on Wildlife Menu

By R. R. THOMASSON

Photographs by the Author

Not only tall oaks but frisky squirrels and chipmunks, graceful deer and lilting song birds, from little acorns grow. In fact, the oak is the most important source of wildlife food we have. This means acorns, for the most part, although there is some feeding on buds, bark, and leaves. No less than ninety-six different kinds of wild birds and mammals look to the oak as a source of food.

With a rating of 263, the oak tops the list of wild plants classed according to their value as a source of food for wildlife. *American Wild Life and Plants* by Martin, Zim and Nelson is the authority for this statement. The pine is the only other plant with a rating above 200 in this guide to wildlife food habits. It has a rating of 234, the blackberry 118, and the wild cherry



The gray squirrel, of course, is a noted lover of acorns, and the one above is having a hearty meal. However, assorted acorns like those at the left are high on the menu of many other forms of wildlife.



104. A list of birds and mammals that depend on the oak for at least twenty-five percent of their food includes the white-tailed deer, western fox squirrel, both western and eastern gray squirrel, raccoon, black bear, eastern bluejay, band-tailed pigeon, wood duck, and wild turkey. Others that depend on the oak for ten to twenty-five percent of their diet include the ruffed grouse, purple and brown grackles, white-breasted nuthatch, brown thrasher, red-bellied and red-headed woodpeckers, fox squirrel, gopher, and the rock squirrel of Texas.

Studies by the Missouri Conservation Commission show that acorns constitute as high as eighty percent of

the winter diet of deer in the Ozark region. There is little else on the wild turkey menu from November to April. And bob white quail have been known to eat acorns practically throughout the year.

When a late freeze or a drought results in a virtual acorn failure, there is something of a famine among wild creatures. This is especially true during the winter months. Acorns and nuts are the only items of food in Nature's larder that will give squirrels the sur-

plus of fat needed to carry them through the winter in good condition. The squirrel birth rate declines in a season following a winter of few acorns. Conversely, a year with an abundant acorn crop is followed by a season when young squirrels are numerous.

Donald M. Christisen, biologist of the Missouri Conservation Commission, reports that wild turkeys have been known to eat thirty-five giant northern red oak acorns at one time. That is slightly more than half a pound—a right hearty meal. The white tailed deer may consume four to four and one-half pounds of acorns at a feeding.

It is not without reason that the acorn has been termed the "staff of life" for many wild birds and mammals. Acorns are especially valuable as a source of winter food since they are high in carbohydrates and fats, although low in protein, thus providing energy and fuel during the cold winter months. A pound of northern red oak acorns contains 1300 calories as compared to 1200 calories in a loaf of ordinary bread. And the acorn of the willow oak provides forty times as much vitamin A as does yellow corn.

Since acorns of the white oak group are sweeter, containing less tannin, it might be expected that birds and mammals would prefer them to black oak acorns, with their more bitter taste. And, indeed, Martin, Zim and Nelson say there is evidence that white oak acorns are more palatable to wildlife than are those of the black oak group. A study, however, by the Missouri Experiment Station failed to reveal any such preference. Most birds and mammals eat whatever is readily available. Perhaps wild animals instinctively know that the black oak acorns contain a much higher percentage of fat than do those of the white oak group.

In the Missouri Ozarks the diet of wood ducks has been known to consist of as high as thirty-five percent acorns. Both wood ducks and mallards are especially fond of small acorns produced by water oaks, willow oaks, and pin oaks. This is one of Nature's fortunate arrangements, since both the ducks and these species of oak are found along streams and near ponds. Bob white quails like the crumbs left over from the meal of a squirrel, jay, or hog. They can and do, however, swallow some of the smaller acorns whole.

The size of the acorn does not discourage wild turkeys. One turkey has eaten as many as seventy-seven black oak acorns at one feast. There has also been recorded a wild turkey meal consisting of thirty-five of the large acorns produced by the northern red oak.

Nature has taken precautions to prevent a total acorn failure. Although a late freeze may play havoc with the white oak blossoms, there are immature acorns unaffected by the freeze on black oak trees, which require two years to mature a crop. An article by Albert A. Downs in the 1949 Year Book of Agriculture, *Trees*, tells



Besides his appetite for acorns, the gray squirrel is a competent forester, burying many acorns that grow into great oaks.

us that: "Oaks produce good crops of acorns once in three or four years, on an average . . . We do not know why yields vary from year to year, but weather is probably an important factor. Late frosts may kill flowers before fertilization and even the fruit when it is in the young, tender stage. Possibly oaks need more than one growing season to build up food reserves for a large crop of fruit; oaks of the white oak group (white, post, and chestnut oaks) ripen their acorns in one season, but oaks of the red oak group (northern red, scarlet, and black oaks) need two years to ripen their seed."

"The production of acorns varies not only from year to year but from tree to tree of the same size in the same year. In 1942 a 27-inch scarlet oak produced approximately 46,000 acorns; other scarlet oaks near by of the same size produced a fraction of that number."

Mr. Downs tells us that on an average a tree eighteen inches in diameter four and a half feet from the ground may be expected to produce crops of acorns, in terms of pounds, as follows: Chestnut oak, 8.1; white oak, 6.7; northern red oak, 14.5; black oak, 3.4; scarlet oak, 12.1.

The scarlet oak is a profligate producer of acorns. It may have an abundant crop one year and then miss several years.

The productivity of a good tree appears to be dependent quite largely upon the size of the crown. There is some indication, however, that certain trees have an inherited ability to produce large crops of acorns. Biologists have hopes of producing strains that will yield larger crops. In any event, it is recommended that, whenever possible, seed trees be selected for their productivity.

The variability in the productive capacity of trees is indicated by the Missouri study also. We are told that: "In Dent County the most prolific of the white oaks yielded an average of 7700 acorns per year (over a period of 7 years). The least prolific produced only 100 acorns . . . The average number of sound, mature acorns produced per tree varied from 11 for post oak to 153 for white oak. . . Post oak was a consistent but low producer; the other species though abundant producers in some years occasionally produced small crops. Scarlet oak appears to be especially erratic and unreliable.

"Assuming that mature acorns (*continued on page 330*)

A Vertical View of Nature

By GRACE SHULTS DAVIS

Photographs by the Author

MY WANDERINGS that led to the petrified pine cone took place before the time of Jeeps. But in those days there were the high-bodied, high-axed Ford coupes, designed less for speed and more for safe visibility of the road ahead.

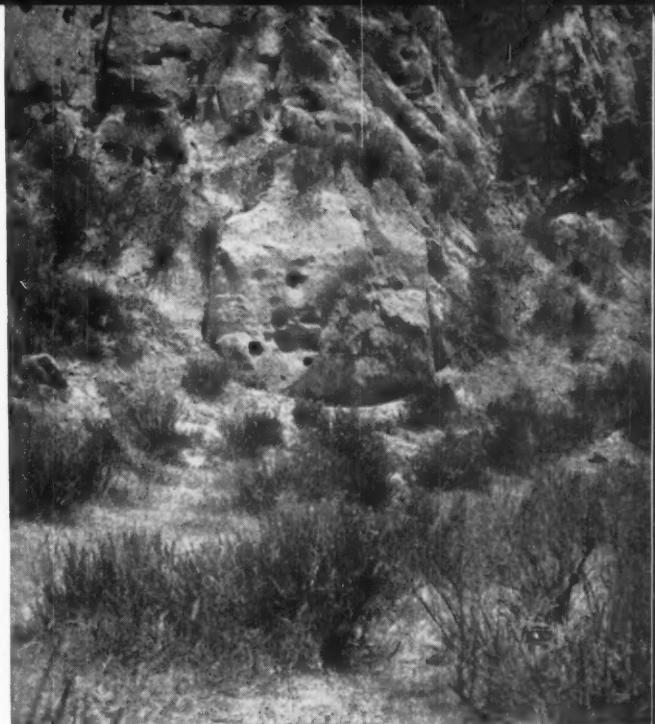
So, back in the 1930's, my Ford coupe carried me sedately each week day to the high school where I taught biology. Weekends I donned slacks, and, with my Ford also turned boisterous, drove along beaches, or climbed the roadless hills, or scampered across the deserts of the dry-grounded Southwest.

One weekend I headed for Beaumont, California. Beaumont is one hundred miles southeast of Los Angeles. It is referred to as the "Pass City." There the elevation reaches 3500 feet, and Highway 99, which has wound its way through the hills from almost sea level at Los Angeles, slithers through San Gorgonio Pass and starts down grade toward Indio and the Salton Sea, two hundred feet below sea level.

Out from Beaumont, if you leave the Highway toward the southwest, you encounter wild, rough hills in an area listed on road-maps simply as "Badlands." They would be "bad" lands for agricultural purposes. But for specimen-hunting botanists, for Nature students, for archeologists, or for just plain healthy, husky hikers the locality is a paradise.

The bouncing coupe negotiated the smoother hills.

From the hill where the author's car was parked the chaparral-covered "badlands" stretched out and away. A partial view of the bluff from which came the pine cone is at the foot of the rounded hill toward the back of the picture.



The petrified pine cone, a Pliocene specimen of *Pinus pieperi*, was found lying exposed at the base of a sandy bluff from which it had been washed by erosion.

Then I parked it on top of a hill where it could be kept in sight, for it is easy to become lost in the folds of the Badlands when one is on foot. Trudging down through the chaparral, it was good to breathe again, on that leisurely spring day, the sagey smell of the hillsides, and to discover the annual renewal of those gay little surprises—Indian paint brushes, wild hyacinths, Mariposa lilies, yellow violets, owl's clover, monkey flowers, and generous masses of wild lilac.

Coming across the petrified pine cone was an added and unexpected event of that day. The occasion opened up a sort of a vertical world of Nature, in addition to the broadly pleasant horizontal one more easily in evidence.

The pine cone was lying in plain view on top of the ground at the foot of a sandy bluff. It must originally have been buried in the bluff, which was gradually sloughing off through the erosion of weather. Rain and wind had finally carried away the enveloping sand and left the object exposed. It was, indeed, a surprise to pick up the cone and discover it to be heavy, hard stone.

I glanced up at Mount San Jacinto, thirty miles in the distance and rising into the sky, its pine-clad sides and snow-covered top some ten thousand feet above sea level.

"Had the pine cone been carried down



from the slopes of San Jacinto?" I wondered. Recalling, then, that the pine cone had come from a far-off geological age, I began to speculate as to what the topography had been like at that time, and the weather, and whether the vegetation could possibly have been the same as at the present time. This would have to be looked into in order to satisfy my curiosity and get maximum enjoyment out of finding the archeological relic. The idea seemed urgent enough for me to consider dashing for the car and hurrying back to the city to do some research. But the hill, looming just ahead, called a little louder and won the decision. I shifted the weighty stone for easier carrying, and started up the hillside. It really was not necessary. The other side probably looked just like this one. Amused, I thought of the little ditty we sang as children:

"The bear went over the mountain, the bear went over the mountain, the bear went over the mountain, to see what he could see."

"The other side of the mountain, the other side of the mountain, the other side of the mountain, was all that he could see." Soon humming it was not enough. I began to sing it out loud. That was a challenge. These weekly hikes were really developing my wind. Did I have enough lung power to sing as I climbed? Surely! And with only the hills to hear, there was no need to keep my voice low.

Timing it just right, I rose up over the top shouting with noisy volume, "The other side of the mountain was all —" It was *not* all. In the valley below stood a man with a shovel. He had stopped his digging and was looking my way. His open mouth testified as to his bewilderment.

Luckily I did not turn and run back down the hill. The man proved to be Guy Hazen, sent out by the University of California to do some digging in the region. The scientists there were also interested in the geological



The front view of the petrified pine cone showing the well-preserved scales. (Below) A side view of the cone, showing how its original shape had been flattened by the pressure upon it.



story underlying the Badlands of Bautiste Creek and San Timoteo Canyon. I traded the ancient pine cone (gladly under the circumstance of its increasing weight) for information and the promise of bulletins containing additional data.

In that locality were plant-bearing deposits extending over an area of about two miles, the general region being known to geologists as the Eden Beds. Here the layers of earth and their deposits of fossils attest to the several ups and downs that this region had undergone in geological history. The Eden Beds, proper, are 1500 feet in thickness, and there is an underlying layer known as the Red Beds, 1800 feet thick. Fossil seeds and leaves are found in the upper layer, along with the best-known representation of a mammalian fauna of the American Uppermost Pliocene.

In a lower layer, deposits of sea shells tell the story of vast geological changes.

Geological history has been described in four big eras since the appearance of living substance on the earth. In order these are: Palaeozoic (earliest), Mesozoic, Tertiary and Quaternary, each representing many millions of years. The latest division of the Tertiary is called the Pliocene. It was during the Pliocene period that the deposits were made in the Eden Beds, underlying and outcropping in the Badlands where hiking is a pleasure today.

Scientists, in their diggings in the Eden Beds, have pieced together a jig-saw picture of the flora that existed as living tissue in those far-off ages. They find that there were six types of habitats, as evidenced

by the vegetation fossils that have been found. In a low-lying desert basin material was transported from several plant formations occurring on the adjacent mountain slopes. Growing along the drainage lines of the desert were the ancestors of today's willows, cottonwoods, poplars, and the several species of *Prunus*. Above this association was a savannah of oaks and grasses, and

on the upper edges of the savannahs were the open forests of *Pinus pieperi*, a fossil form of the modern digger pine, *Pinus sabiniana*. Through and above the ancient digger pine forests was a chaparral cover of *Ceanothus*, California lilac, *Cercocarpus*, mountain mahogany, and *Juglans*, California wild black walnut. In the upper ridges of the *Pinus pieperi* forests occurred the Pliocene ancestor of the present Coulter pine, *Pinus coulteri*. It was such a pine that bore the cone, which, after a million years of interment, came to the light of day.

The archeological explorations made by the University of California scientists in the Eden Beds have established the presence of the above-mentioned flora in the Pliocene period by the unearthing of seed and leaf fossils. The grasses are represented by abundant remains of monocotyledonous leaves, and their presence is corroborated by the occurrence in these beds of such grazing mammals as *Pliobippus* and *Pliauchenia*. Then there are the seeds and cones of *Pinus pieperi* and *Pinus coulteri* (my specimen). Fossil seeds of oaks have been found, equivalent of the coast live oak, *Quercus agrifolia*, and fossil species of willows and cottonwoods.

Modern equivalents of all the fossil species are growing today, some of them in shifted habitats because of climate changes. It is pleasant, even if not scientifically correct, to guess that in between the trees and the larger shrubs of the chaparral and among the grasses, there were the same bright-hued wild annual flowers. Man appeared in the Pliocene period. There probably were no cave-teachers running over the hills singing "The bear went over the mountain," but likely the cave-children, and perhaps even some of the grown-ups, found delight in seeing the flowers each spring.

Scientists have made an interesting deduction with regard to the climate in the Pliocene period. Many of the fossil forms found in the Eden Beds are not repre-

sented by living forms in this same area today, but by those that occur farther south in Lower California and Mexico proper. They are the plant forms that reach their best development in the desert under a rainfall of five to ten inches annually, while the chaparral now growing in the Beaumont hills exists under an annual rainfall of twenty inches. Climate, then, was much drier during the Pliocene period than it is now. Weather conditions at the present time have returned to conditions more like that of the Mesophytic time. With increased rain about the time of the cave man, certain desert flora evidently retreated southward and today are not found in California.

Bouncing back toward Los Angeles in my faithful Ford over Highway 99, I glanced at my camera on the seat beside me and thought of the exposures it contained of the fossil pine cone. It seemed that I could feel the weight of the cone in my hands once more. The word "histometabasis" was buzzing in my brain. "Histometabasis"—"tissue exchange." Molecule by molecule the original tissues of that pine cone had been replaced by the petrifying agent so that each tiny cell ("histologic structure," the geologist would call it) was preserved in minute detail. Later on crystallization probably took place, destroying the minute structure but keeping the outer shape in a less-destructible form. Down through the thousands of years the original shape of the pine cone was made permanent in stone. In all probability seeds from other cones of the same mother tree sprouted into new little pine trees, which, in turn, produced others and others and others, until that same tissue in living form, sap and cellulose, was carried down to the *Pinus coulteri* of the present time.

A great sense of security and peace and well-being came over me. Time is not fleeting. Time is enduring and filled with goodness.



ANGLED AND FAULTLESS— PERISHABLE, TOO

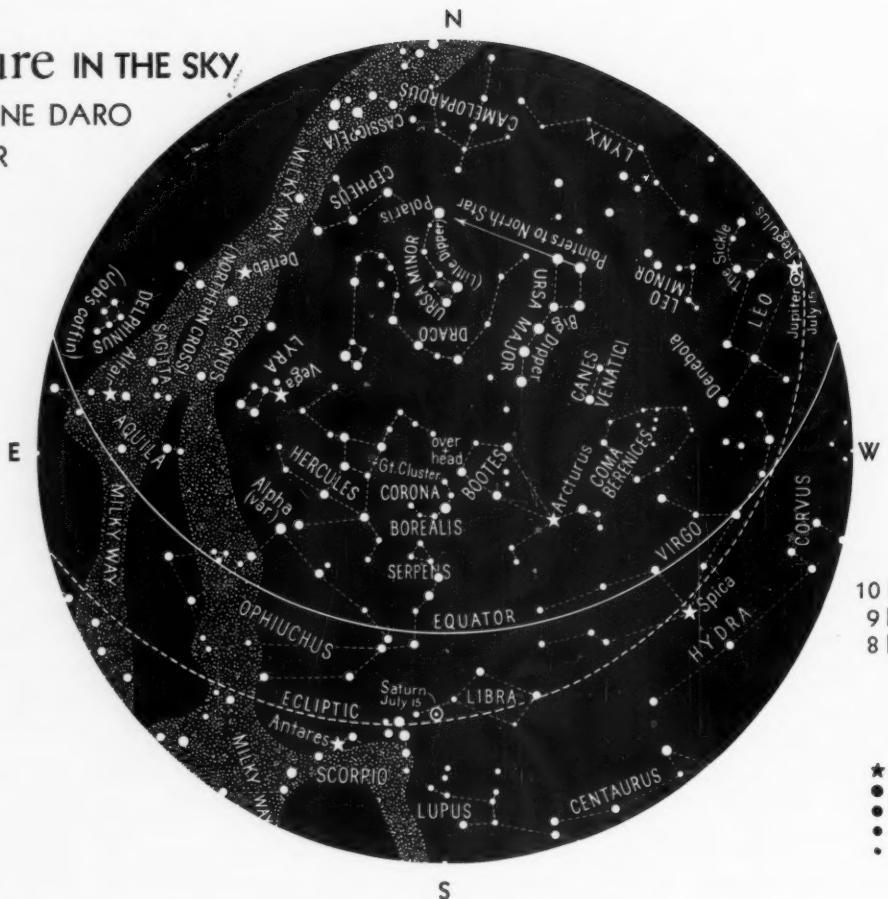
*Along a silver thread my flashlight goes
Hurrying the weaver to the anchored leaf,
From thence to her space-platform for a brief
Pause to form an angle matching those
Already measured from the captive rose
To the Euclidian center; cabled grief —
Precise, relentless, laddered by this chief
Craftsman and butcher, with omniscient toes.*

*This wheel, this universe, this theorem
Described in silk and mucilage and dew,
Angled and faultless, is perishable, too,
As are the gauze winged victims. Pity them
And pity, likewise, creatures — I and you —
Who, out of death life's heady draught must brew.*

Ella Elizabeth Preston

Nature IN THE SKY

By SIMONE DARO
GOSSNER



10 P.M., June 15
9 P.M., July 1
8 P.M., July 15

★	1 ST	MAGNITUDE
●	2 ND	" "
○	3 RD	" "
□	4 TH	" "
•	5 TH	" "

To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the

map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

Telescopes

THE selection of a suitable telescope for astronomical work is always determined by the type of observations that will be required. Strange as it may sound, magnifying power is rarely important, and is never a property of the telescope itself. On many occasions we hear people ask: "What is the magnifying power of this telescope?" There is no answer to this question, as we shall see.

Telescopes may be classified broadly into two categories: Refractors, which are made up of a system of lenses, and reflectors, which contain at least one mirror. In both cases, the primary function of the lens, or the mirror, is to gather light from the stars and to focus it on a viewing device. The light-gathering power of the instrument is in direct proportion to the area of its objective—as the lens, or mirror, are called. For example, a ten-inch lens gathers four times as much light as a five-inch lens, and thus enables us to see compara-

tively fainter stars. This is equivalent to saying that the bigger telescope enables us to see farther into space. Because of this, the past tendency has been to build larger and larger telescopes.

There is, however, a limit to the size of refractors. Telescope lenses are thin, and, inasmuch as the light must be allowed to pass through the lens, it can be supported only around the edges. Beyond a certain size, this type of mounting would inevitably cause it to sag, producing distorted images, or even to crack or break in the worst cases. In consideration of this, it has not been deemed practical to build refractors bigger than forty inches in diameter. The largest in existence is the 40-inch telescope at Yerkes Observatory.

Mirrors, on the other hand, can be supported from behind, as the light is merely reflected from the front. They can also be made as thick as is required to prevent distortion. Therefore, there is no theoretical limit to

the size of reflectors, except perhaps for engineering difficulties, and, of course, budget limitations. The largest reflector in existence is the 200-inch telescope at Mount Palomar. With the advent of other observing techniques, such as the radio telescopes, it is unlikely that the need will ever be felt for a conventional reflector larger than the Palomar instrument.

When the first telescope was invented, at the beginning of the seventeenth century, a single converging lens was used as the objective. The image was viewed with a dispersing lens serving as eyepiece. Single lenses have the great disadvantage that the various colors of the spectrum come to focus at different points; thus the image of a star would appear as a series of concentric circles, each of a different color of the rainbow. In order to minimize this effect, the astronomers of the seventeenth century built telescopes with tremendous focal lengths. The instruments became so long that it was no longer possible to encase them in a tube. Objective and eyepiece had to be attached at the ends of enormously long poles. The resulting instruments were cumbersome and unwieldy. In the first half of the eighteenth century, Chester More Hall discovered that the color error of single lenses could be compensated almost entirely by combining two lenses of different composition (crown and flint). The first so-called achromatic lens—i.e. lens without color—was made by John Dollond in 1759. Dollond's telescopes had to be only one-twentieth as long as a single lens telescope of equal performance.

The color correction of refractors is designed in general to give the best performance in the type of work for which the instrument is intended. For a visual instrument the lens is so designed that red and yellow light will focus almost at the same point because this corresponds to the sensitivity of the human eye. All achromatic refractors built before the advent of photography were corrected thusly. Nowadays, very little visual work is done in astronomy, and telescopes are designed for photographic use. Unfortunately, the sensitivity of ordinary photographic film is a maximum in blue light. As all the largest refractors were built before astronomical photography came of age, they are all corrected for the visual range, and, in general, blue-sensitive film cannot be used. In some cases an attempt was made to modify the optics of the instrument accordingly, but the cost of making a new lens of such proportions was usually a deterrent. When yellow-sensitive (orthochromatic) films were introduced, visual refractors became readily adaptable to photographic work and there was no further need to modify their optics.

No such problem exists in the case of reflectors. A mirror reflects light in the same fashion, regardless of its color. Telescope mirrors are concave. Spherical ones are not satisfactory in the conventional reflector because

of the serious distortion of images formed from oblique rays. In general, a parabolic mirror is used. Distortions are still present at the outer edges of the field, but a much larger portion of this field is usable. Thanks to the absence of color error, it is possible to use reflectors with much smaller f/numbers. The f/number, or focal ratio of any telescope or photographic camera is the ratio of the diameter of the objective to the focal length. A large f/number minimizes the effect of the color error in

lenses, but it also reduces the speed of the instrument when used photographically. Refractors are commonly built for use at f/12 to f/15, while reflectors may be used at f/5 or even less, provided the optics are somewhat modified to improve the images at the edge of the field.

Magnification is to be considered only in visual work, and only if the celestial object one wishes to observe presents a visible surface, such as the moon, planets, and nebulae. Stars, even the nearest ones, are pin-points

of light and remain so regardless of magnification. Photographs of the heavens are misleading in that respect to the non-astronomer. Photographic images are built up on the film according to the intensity of the light. Thus the size of a star's photograph is related to the brightness of the star, and not to its actual size. The amount of magnification provided by a telescope is the ratio of the focal length of the objective to that of the eyepiece. Most visual telescopes come with a number of interchangeable eyepieces, each with a different focal length. Thus the same telescope can give different magnifications according to whichever eyepiece is used. In the case of photographic telescopes, the objective plays the role of the camera lens, and the film takes the place of the eyepiece.

It may be a shock to learn that astronomers no longer "look at the stars," but it is a fact that almost all astronomical observations made today with conventional telescopes are done photographically. Visual work is practically non-existent. This procedure enables the astronomer to inspect the photographic records at leisure in the laboratory and to repeat the measures as often as is required to insure accuracy. Furthermore, the photographic process may be termed cumulative. During a long time-exposure, which may run for several hours, the image of a faint star builds up gradually on the film, so that stars that are too faint to be seen through a telescope can be photographed with the same instrument.

Large reflectors, such as the 200-inch at Mount Palomar and the 100-inch at Mount Wilson, are suitable for detailed studies of very remote objects, particularly galaxies. On the other hand, the serious distortion that is always present at the edge of the field of such instruments makes them inadequate for the precise measurement of positions (astrometry). In the latter case a long-focus instrument is needed (continued on page 327)

FAR GLIMPSE

*The great horizon dark and chill
Offers its starlight small and thinned.
Upon a tiny point of hill
I stand in the unfeeling wind*

*And think, how quiet are the stars!
And how blind shapes beside me go!
Around are hopes and fears and wars
And so much I can never know.*

Daniel Smythe

Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University,
and Director of Nature Education, The American Nature Association

Lessons of Colonialism

IT HAS LONG BEEN the practice of this page to suggest school activities appropriate to seasonal events of general interest. Since we have no exclusively July issue of *Nature Magazine*, Independence Day, or the glorious Fourth, has been more or less ignored. Still, to most of us, this is one of the most significant of all historic holidays, and one that should not be neglected in any well-rounded program for use in school or out.

We have also tried on this page to suggest situations in the field of natural science that may bear some significance to situations that may be of special interest in the field of social science as it applies to human relationships. Under these circumstances, and since there seems to be a movement to disparage the idea of colonialism without recognizing its advantages, it is appropriate to emphasize it here.

According to the dictionary, colonialism is a system of extending government by the introduction of colonies into new territory. Colonies are aggregations of organisms segregated from the parent body and usually with a common ancestry, and with some unanimity of purpose. These colonies usually retain some tie-up with the mother country or parent group. This may be concerned with traditions, with common interests and common problems. The tie may be casual and voluntary, or it may be closely tied by force, or by habit. If the tie-up is mutually pleasant, it may be relatively permanent. If it is not so, antipathies, justified or petty, may arise that may weaken the bonds as time goes on. Eventually, if the colony is capable of sustaining itself, it may sever the connection with the parent group, declare its independence and may continue its existence closely or remotely associated with the mother group.

Changes of territory

In not a few groups of the social insects, we find that when populations increase small colonies will make their way to new territory and establish varying degrees of independence. Sometimes, as with some of the ants, slaves may be made of the neighbors in the new territory. Probably more commonly, we find mutual adjustments being made where new ideas, new blood, new markets and new associations may increase the prosperity and happiness of all involved. Colonialism is not necessarily bad for anyone any more than is stagnation resulting from a static population with no pioneering instincts. Most frequently difficulties arise when the members of a new generation, lacking the experience of its predecessor, determine policies that are unwise. This happens with young woodchucks, which, as this article appears in print, will begin to wander on their own away from the home den. Possibly it happens when governments, forgetful of the lessons of Danzig and the Polish corridor, establish a Berlin with no corridor at all. It may even happen where lessons taught by a civil war, by a depression or by dictatorships of labor or capital are ignored. Colonies of woodchucks, of Poles, of racial groups, of economic groups without the opportunity of renewing ties with parent groups must be strong to survive isolation. Either that or they must demonstrate to their neighbors that the new association is to be desired. Strangely enough, often the new colony, whether it extends its influence east, west, north or south, whether it is a forest society taking over unforested areas, marshland marching into a waterway, or an eroded desert moving into fertile farmland, must rule its neighbors, be ruled by them, or make mutually reasonable adjustments. In some ways, improvement may result from any of these three alternatives.

Colonial frictions

Frictions associated with colonialism usually arise when the immigrants refuse to recognize the merits of the new territory being occupied. Persons, or animals, or plants, displaced from their native territory by accident or otherwise, frequently try to make over their new environment into something comparable to that they left, even though they left the home territory in disgust or to avoid unpleasant elements. This is sometimes rather hard to understand. Further frictions arise when, for one reason or another, it is difficult to recognize just where allegiances may be and what kind of animal is masked by a sheep's clothing.

Personally, I find it difficult, in view of the record in my State and in the Nation, to determine which political party is the best friend of conservation, whether Mr. Morse is a Republican or a Democrat, and for that matter just what is the difference between the major political parties if we try to measure them from more than a few angles. When politicians create political platforms to win our support and then promptly ignore those platforms; when armies agree on a truce and ignore immediately the terms of those truces; when dictators claim to be democratic and do not allow free elections; when the country advancing its aims by the method of colonialism disparages colonialism generically, how can we continue to be rational?

For years *Nature Magazine* and those associated with it have been trying to establish in our schools and elsewhere colonies of persons who recognize merit in learning from the realities of Nature. We have tried to establish colonies of Nature lovers and of students who learn from Nature both in the schools and out. When we recognize the phenomenal growth of conservation education, which at its best is applied Nature education, we feel proud of our accomplishments. When we recognize the entrenched conservatism of many school people who still learn their "science" from books, we are rather discouraged. We rather think that, given time, all groups involved may learn something from each other and the colonies of Nature-minded folk will have served a useful function all along the line.

Role of Nature study

It would seem that the role of

true Nature study may lie in continuing to serve not only as pioneers in pointing out new opportunities to those not trained in the Nature field, but in continuing to serve as a check on those who would get so far off the ground so far as facts are concerned that a dangerous situation may develop.

A few months ago I was asked to review the page proof of a book on Nature reputedly prepared by some of the great names in the Nature field. In it I read that botanists grouped plants by structure. "First there are tallophytes or bacteria, algae and fungi; second, bryophytes or ferns and liverworts, and, thirdly, the pteridophytes or seed-bearing plants." If you can find much of fact in that statement by a Ph.D. then I do not know what it is. Again we find "Rabbits, mice, snakes, birds and insects are in abundance feeding on plants." The author failed to mention the plant-eating snakes to which she referred, or how "earthworms herald the coming of spring." This sort of thing is, of course, ridiculous but if those with this philosophy begin colonizing in the educational fields where Nature study has established a reputation for sticking to the facts, we may yet have a war on our hands.

Interestingly enough a year or so ago, when I was in the hospital, a manuscript was sent me by a new writer for review. I was asked to help get it published. I wrote back to the effect that I had gone over the manuscript but did not think I could get a publisher. This week's mail brought me a book based on that manuscript. In the introduction acknowledgement is made to "E. Laurence Palmer for reading the manuscript," but no mention is made of the fact that I did not approve its publication or assist in getting a publisher. I sincerely hope that none of my friends feels that I approved the classification of toads and leopard frogs as reptiles, or the recommendation that garter snakes feed largely on mice and insects. I could go on indefinitely in this way, but no good would result from it, I am sure. Apparently, if the true Nature philosophy is to become established, we really need to establish more and more colonies of persons qualified not only as educators but as scientists as well. I confess this book, just received, is decidedly discouraging to one who has tried for the

major portion of a lifetime to advance the study of truth in schools and out, through the study of Nature not books. Usually the character of the colonists determines the success of colonialism.

Telescopes

(Continued from page 325)

and one would thus use a refractor.

The summer solstice, or beginning of summer, will take place on June 21 at 5:24 A. M. Eastern Standard Time. The earth will be at aphelion on July 5. On that date the earth will be at its farthest point from the sun for the year.

The New Moon will occur on June 8 and July 8, and the moon will be full on June 23 and July 22.

Mercury will be a morning star during the whole month of June and until July 19. It will be found west of Aldebaran on June 15, and will be in conjunction with Venus on July 3. By the end of July it will be poorly placed for observation.

Venus is rapidly approaching the sun and will be hard to observe during the month of June. After June 22 it will become a morning star and by July 15 it will be rising 2 hours before the sun. In Taurus by the end of July, it will reach its greatest brilliance on July 29.

Mars will rise just before midnight on June 15. By July 15 it will be rising at 9:45 P. M. In Aquarius, it will still be seen low on the south-southwestern horizon at sunrise.

Jupiter will be seen in the early evening only. It will set at about 11 P. M. on June 15. In the month of July it will set in the evening twilight. It will be found in Leo, in the vicinity of Regulus.

Saturn, in Libra, will be seen almost all night during the month of June, but will remain low in the southern horizon. By the middle of July it will set at about 1 A. M.

Robot Weather Station

A prototype marine weather station that automatically reports local weather data by radio has been developed by the National Bureau of Standards. The unit is incorporated in a buoy that can be anchored in remote locations and left unattended for periods up to six months. At regular intervals throughout the day the station broadcasts in code the air temperature, water temperature, barometric pressure, and wind speed and direction.

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THE Nature CAMERA

By EDNA HOFFMAN EVANS

Telescope Photography

THIS WORLD OF ours is getting smaller, as everyone knows, owing to the great strides made in transportation and communication. Actually, though, the more I learn about people, the more I am inclined to believe that the world never was so very large, and that human beings are pretty alike wherever and whenever we find them.

Folklore contains many good examples of what I am talking about. Why is it that we find the same themes and the same motifs in folk tales, no matter whether the stories are told by a tribe in Africa, or by an entirely unrelated tribe in South America? Hindu and Englishman, Norwegian and New Zealander, Eskimo and Navajo, Bushman and Alpine mountaineer—they all share some of the same basic drives and emotions. People, regardless of nationality, color, creed, or time of existence, have their loves and their hates, their jealousies and their greeds, their goodness and badness, their heroes, saints, and sinners. Circumstances vary, as do superficial customs, but the deep-down roots are much the same everywhere.

In science, too, a strange similarity often occurs. There have been a number of instances—too many to be solely attributable to chance—where scientists in different countries, or even on different continents, have worked along similar lines and come up with remarkably similar discoveries at the same time, without either scientist knowing that another was investigating the same field.

Like photographic interests

This all may seem like a far cry from photography, but it is not, really. The queries I receive and the letters I get often follow similar patterns, indicating that no matter where in the country a reader happens to live, his photographic interests and problems can be paralleled somewhere else.

The material I used on star photog-

raphy in the previous issue was just such an example. I have had on my desk for some weeks material about another amateur photographer-astronomer who is interested in similar activities. This section will deal with his techniques.

Paul Griffin hails originally from West Virginia. He did a hitch in the Navy and then settled in Arizona, where he and his family—his wife, Jewell, and two children, Dana and Russel—share many interests and activities, ranging from piano lessons to model railroad building and astronomy. The reflecting telescope in the Griffins' back yard is the product of Paul's home workshop, with parts coming from many different sources not remotely connected with astronomy.

Like Mr. Boughner of Palatine, Illinois, whose astronomical photography was described in the May issue, Paul Griffin of Phoenix, Arizona, first turned his telescope and his camera lens on the moon and the stars. But the techniques the two men used to get their photographs were somewhat different. Paul Griffin took his first moon pictures on 120 Verichrome film (daylight exposure index 64) and his camera was a pre-war, German-made model called a Super Sport Dolly. His moon exposures were made at 1/10 second, with a lens aperture of f 2.9. These settings were determined by holding a Weston exposure meter to the telescope's eye piece.

There was some difficulty, of course, in hand-holding the camera for a 1/10 second exposure. Most authorities advise a tripod for anything slower than 1/25 second. But it can be done with a fair degree of success. Actually, however, some sort of a bracket to hold the camera steady at the telescope eye piece would be a better set-up.

Photography of moon

Griffin's telescope is powerful enough to pick out the moons of Jupiter, the rings of Saturn, the nebula in Orion, and, of course, the craters on Earth's own moon. Inci-

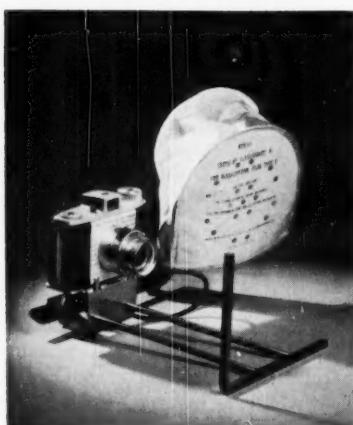


This sunspot photograph was taken by Paul Griffin of Phoenix, Arizona, through a home-made telescope with a home-concocted lens shade. The exposure was made at f 2.9 for 1/10 second.

dently, here is a pointer for other photographer-astronomers. Griffin has found that the best time for moon photographs is while the crescent is still rather small, preferably before it reaches half-moon size. Full moon is the worst time of all for lunar photography because of the super-abundance of light. The illumination from the face of the full moon is so great that many of the craters, seas, and mountain ranges are blotted out by the light reflected from them. But, on the other hand, when the moon is waxing or waning, the light comes from an angle and permits the surface irregularities to cast definite shadows, thereby making the landmarks appear on the face of the moon much more clearly.

Another pointer on moon photography—best pictures may be taken when the moon is well overhead. Closer to the horizon, either east or west, there are more layers of the Earth's atmosphere, as well as denser dust, smoke, and other obstructions, that must be penetrated. These, naturally, cut down visibility.

As it is with all moon and star photography, it is best for the photographer and his telescope to be as far as possible from the glow of civilization; from the street lights, signs, and general illumination that shine up from a modern city. These, plus the dust, smog, and smoke raised by the city's inhabitants, are definite deterrents to astronomical observation. Nor are these factors just drawbacks for the amateur. The large scientific observatories are lo-



The Kodak Technical Close-Up outfit brings the camera lens to within seven inches of the subject.

cated on mountain tops or in areas as far removed as possible from the disturbances of urban life, although sometimes an isolated observatory suddenly discovers that the once distant city has unaccountably grown out and gobbled it up.

It is the current crop of sunspots, returning on their eleven-year cycle and playing hob with short-wave radio, that hold the greatest interest for my Arizona friend. To photograph the sun and the strange dark areas that move across its surface, he has used the same verichrome film and camera that he used for the moon. He is also experimenting with a $2\frac{1}{4} \times 3\frac{1}{4}$ press camera, although the images with this are so large that one moon crater usually fills the ground-glass. There are some definite differences in Griffin's sun and moon techniques, owing, of course, to the sun's brightness.

Cutting down light

Rather than put a shade or a screen on his telescope eye piece, Griffin recommends a cap that fits over the open end of the telescope in order to cut down the light. A tin coffee can, or a cardboard Quaker Oats box, will serve the purpose. A hole is cut in the closed end of the container and over the hole some sort of a light-dimming device should be secured. For his pictures, Griffin used a No. 12 shade glass from an arc welder's mask, held in place with masking tape. This glass acted both as a "stop" and a filter.

The Weston exposure meter was again used to determine lens stop and shutter speed and, oddly enough, they were the same as for the moon—f 2.9 at 1/10 second. To take the picture Griffin held the camera about

a quarter of an inch away from the telescope's eye piece, focused on a piece of ground-glass in the back of the camera, loaded in the film, and tripped the shutter.

Of course the pictures that result from such photography cannot by any stretch of the imagination be classed as salon possibilities. For that matter, they are often so unclear and indefinite that a commercial developer will think they are duds and neglect to print them. But even the professional plates exposed through the giant telescopes at the big observatories look pretty unintelligible to the ordinary viewer. So the home-made pictures through the backyard telescopes may not look like too much to the casual observer. But to the interested hobbyist, they are interesting and wonderful, indeed. More power to the astronomical-photographic hobbyists who take them.

OTHER INTERESTS. Since I have found at least two people in different parts of the country who have used slightly different methods for taking similar types of photographs, I wonder if there are others among the readers of this section who have met and solved problems posed in a letter I received recently from Illinois.

The inquirer, an Exakta camera user, wanted to know:

First, "is there any kind of an instantaneous solenoid shutter release

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so that I can catch an animal or bird in an exact chosen pose where the human reaction time would be the slowest factor?" The writer says that if he can find such a device, he has a theory he wants to try out in night photography of small animals. The solenoid supplied as an Exakta auxiliary, he reports, is too slow for his purposes.

Second, the same photographer wants "an electrically operated device which could be mounted on an Exakta to advance the film from a remote control position so that sequence shots could be obtained without disturbing the subject." Whether such a device exists is not known to me or to my correspondent. If some other reader knows of such a device, it would be nice to hear from him.

Another letter, this one from a prospective camp counselor in California, asks for information about "rigging up a still flash camera to bait for night work." It has been more than a year since any space was devoted to this type of photography—March of 1955 to be exact. I wonder whether readers have any successes to report or picture-taking devices to share in that field. If so, please let us hear about them.

NEW DEVICES. For movie-makers, Bell and Howell has a new 8mm model, the Monterey Deluxe, on the market with an f 1.9 lens and "sun dial" lens settings. It retails at \$59.95. This is the most elaborate of a trio of 8mm cameras, the others being the Monterey with an f 2.3 lens (price \$49.95) and the Wilshire with an f 2.5 lens (price \$39.95).

They feature "set, sight, and shoot" operation, while a twist of the sun dial to a written description of the outdoor light automatically sets the lens. By sighting through the large picture window viewfinder, the operator can see his scene in actual size.

For photographers who like to get close to their subjects, Eastman has a new Technical Close-Up Outfit designed especially for use with the new Kodachrome type F and Ektachrome type F films.

Included in the kit are a Kodak Pony 828 camera, a B-C flashholder, a bracket and field frame for establishing the location and area to be photographed, Kodak Flashguards A and B, a series V adapter ring, and a series V Kodak portra lens 5. The field frame outlines an area $3\frac{1}{8}$ by $4\frac{1}{8}$ inches at about seven inches

from the camera. This is the exact focus and fills the entire negative. Pictures are made by placing the field frame against or around the subject; it is not necessary to compose and focus each picture individually. Normal shots of from $2\frac{1}{2}$ feet to infinity also may be made with the camera. The outfit is priced at \$62.50. ♦♦♦

"Zipper"

(Continued from page 318)

to get into his den.

We last saw the weasel in late August when the boys rushed in shouting, "Zipper is back." No other weasel has ever been in this locality and the boys were sure it was Zipper. The animal seemed well adjusted to natural surroundings, looking more slender and a bit scarred about the face, perhaps from the encounter with the ground squirrel. Although as fearless of us as before, he no longer gave the baby-like "zip" call.

The long-tailed weasel appears to be abundant in Glacier National Park. I have observed them often on both the east and west slopes of the Continental Divide. They prey on the abundant Columbian ground squirrels, helping to balance the rodent population. Although the long-tailed weasel is widely distributed in North America it is not observed often because of its secretive habits and rapid movements. ♦♦♦

C. & O.

(Continued from page 317)

National Monument lands at Harper's Ferry, West Virginia, and the whole unit be preserved as far as possible in its historic and natural state.

The Wirth memorandum does not officially end the great canal controversy, for the new Park Service recommendations must be implemented by further executive action and the releasing of additional funds. However, conservationists feel certain that Mr. Wirth's recommendations mean that they have come close to winning their fight to protect the canal sanctuary. They believe that the result of the canal controversy has national significance. Many are of the opinion that there has been an unfortunate trend in the philosophy of recent Federal planning that to develop a natural area for popular use it is necessary considerably to modify or eliminate many of the

wild natural features, and to equate park development with road building. Conservationists believe that the intensive, well organized and publicized fight to save the canal was valuable because it demonstrated that a large segment of the public objects to this philosophy.

However, Nature enthusiasts of the region are chiefly jubilant over the new Park Service decision for a far less theoretical reason. They believe now that the old canal and its tangled right-of-way will remain largely untouched and unspoiled, a place where, as Justice Douglas says, "the whistling wings of ducks make silence have new values." These outdoor lovers hold that the protection of untamed recreation areas is not a luxury but a necessity for the future well-being of our already over-urbanized communities, and that such spots as the Chesapeake and Ohio Canal are vital sanctuaries, not only for birds, animals and plants, but also for city-ridden humans seeking moments of peaceful escape. ♦♦♦

Acorns

(Continued from page 320)

not used by insects are available and that the stand consists of 20 seed-bearing trees per acre evenly distributed among the five species studied, the average number of acorns available for food would be approximately 4000 per year per acre representing a weight of about 20 pounds."

We can expect the white and post oaks to produce good crops about every other year. The result of a rather intensive study of a group of one hundred oaks in Missouri is interesting. One of these, a post oak twelve inches in diameter and fifty feet tall, produced slightly more than 10,000 acorns in one season. Some of these dropped prematurely and some failed to ripen. Of the 4466 nuts that reached maturity more than three out of every four were infested with insects. Acorn weevils predominated. Squirrels and birds (mostly bluejays and woodpeckers) got 58 of the remaining 581 sound acorns, leaving 523 sound acorns that fell along with those that were infested with insects. Deer, turkey, and other wildlife accounted for 324 of these leaving 199 for reproduction. Actually, of course, some of those taken by squirrels probably were buried and never recovered. Squirrels are excellent foresters. ♦♦♦

For Gardeners

An Easy Guide to African-Violets. By William L. Meachem. 64 pages. \$1.95. *An Easy Guide to Color and Flower Arrangers.* By Margaret Dodson. 54 pages. Illustrated. \$2.50. *The Complete Book of Garden and Outdoor Lighting.* By Bernard Gladstone. 120 pages. Illustrated. \$2.95. *Giving and Getting Awards for Flower Arrangement.* By Emma Hodkinson Cyphers. 56 pages. \$1.95. All published by Hearthside Press, New York 16, New York.

These four attractive and practical books for gardeners were received together for review and seem appropriate for joint mention. The discussion of African violets should help to answer the questions that seem to arise when violet fanciers get together. The two little books on flower arranging appear simple, practical and suggestive, and bid fair to enjoy a hearty reception among garden club members. The volume on lighting the garden and outdoor areas around the home covers a field in which there is little current literature. All of this quartet are attractive books and a credit to their authors and publishers.

The World of Night

By Lorus J. & Margery J. Milne. New York. 1956. Harper and Brothers. 248 pages. Illustrated by T. M. Shortt. \$3.75.

"Man is a prisoner of daylight," say the authors in the opening sentence of this delightful and informative book. A bit later on they say: "In darkness the world is new and relatively unexplored." From that point on the Milnes take the reader on a fascinating exploration of the night world. Because the authors have traveled widely they are able to write of night on the seashore and in the jungle; on the desert and in polar climes. They tell of night in the forest, and about the bat, that symbolic creature of the night. Needless to say, the book is written with all the charm of expression for which this husband-and-wife team of naturalist-writers is noted. It is a welcome addition to the list of their already widely appreciated books.

Birthplace of the Winds

By Ted Bank II. New York. 1956. Thomas Y. Crowell Company. 274 pages. Illustrated. \$4.50.

During the war, Ted Bank was stationed in the Aleutian Islands, an experience that left him with an ap-

petite to return. So he organized what he called "Operation Shoestring," and was half of a two-man expedition with ethno-botanical goals in the windswept islands that finger out from Alaska. There he explored burial caves and studied the plant life of the islands and their uses by the early Aleuts. Mr. Bank writes well and this book takes the reader right along with the two-man expedition, sharing its excitement of discovery.

Nature Photography Guide

By Henry D. Shumway. New York. 1956. Greenberg. 126 pages. Illustrated. Paper-bound, \$1.95.

This is a practical guide to the photography of Nature subjects by a photographer-writer who has done much work in this field. He emphasizes the wide variety of subject matter available to the Nature photographer and the special challenges inherent in this camera specialty. Photography of insects, birds, wildflowers and mammals by night are the subjects of individual chapters. One chapter is devoted to making Nature movies and another to macrophotography. Mr. Shumway has provided a useful little book. Our review copy looks as though the printer had printed it without what is known in the trade as "make-ready," but perhaps ours was one of the first to come off the press.

Briefly Noted

Towser: Sheep Dog. By Henry G. Lamond. New York. 1956. E. P. Dutton and Company. 256 pages. \$3.50. Life on an Australian sheep station during the first decade following the turn of the century.

Tree Tops. By Jim Corbett. New York. 1956. Oxford University Press. 30 pages. Illustrated by Raymond Shepard. \$1.75. The story of the 1952 visit of Princess Elizabeth and the Duke of Edinburgh to Kenya.

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Bird Doctor

(Continued from page 303)

new tricks because new tricks mean more attention.

I have seen a red-shouldered hawk knock itself out two weeks in a row, becoming violently impatient as he waited his turn to be carried outside for the crowd to see. Barney, the blind barn owl, would limp over to the attic door, and wait to be carried outside at exactly 4 o'clock every Saturday and Sunday. On weekdays he always remained in his box in the corner.

Birds under my care are rarely given medicine. Although I can calculate a dose of almost any drug for a newborn baby, I am completely licked by the mathematics involved in figuring a dose for a two-ounce bird. Even whiskey I have found to be too strong as a stimulant for most song birds. Vitamin drops are essential to almost all wild birds in captivity. I put the vitamin drops in the water dish daily.

Splints for broken wings are useless in most instances. Wing injuries, if they are not hopeless from the start, usually heal themselves in seven to ten days. Occasionally when the wing is dragging on the ground, a doll's sock, or a child's sock with the toe cut off can be slipped over the bird, and two holes can be cut out for the legs. But, after ten years of bird-doctoring, I am inclined to do less splinting.

Small cages cause birds more suffering than almost any ailment. A storeroom, a bathroom, a screened-in porch, or a packing carton, make far better quarters for crippled birds than canary and parrot cages. A few birds do well in cages, but only a few. If you must put a wild bird in a cage, be sure to cover the top of the cage, and the sides if necessary. Pine needles in the bottom of the cages make cleaning an easy task. And the pine needles are almost ideal for birds' feet.

My most ungrateful bird patients have been herons. Great blue herons and night herons have long, dangerous bills, which you have to get a grip on first, before you can feed them or give them a diagnostic looking-over. Feeding a heron calls for patience and a nose clamp. I usually use smelts, and work them all the way down the heron's neck. It is like squeezing mud out of a garden hose. But finally the smelt slips

inside, and you turn your back to pick up another. Then you suddenly discover your first smelt lying there, ready for another try.

The best place for herons is in a safe, secluded pond or brook where there are plenty of fish and tadpoles, and no dogs, or children. Taking care of crippled herons is a dangerous and smelly business. The next time I treat one, I am going to have a galvanized bucket on my head with holes cut out, for my eyes.

Many visitors to Washington Crossing Park will recall the old crow that suffered with asthma. He was one of the few birds who had his own medicine bottle. A few drops would relieve his gasping, but the crow despised the medicine so much he hopped out of an open window one day, and even though he was almost completely blind with cataracts, and had one wing completely shot off, he managed to disappear in the woods and we never found him.

Few birds have to be destroyed to end their suffering. Usually all that is necessary is to put the dying bird in a tightly covered box, in a completely dark closet. The suffering bird reacts exactly as any bird (except an owl) reacts to night. He will remain absolutely quiet. If men could die as easily as birds, narcotics would be almost unnecessary.

In spite of the low fees, and the dubious future of bird-doctoring, I will be a bird doctor forever. Or until I become hard-hearted enough to send a child on her way with a box containing a dying robin. ♦♦

"Highbrow"

(Continued from page 304)

jects beyond the upper jaw. Thick lips cover teeth that are blunt, even and close-set, forming uniform and opposed cutting edges. The tongue is thick and muscular.

The eyes of *Zaprora* are quite large and provided with a protective membrane, similar to an eyelid. There is a circle of mucous pores arranged around each eye.

The mucous pores are largest of all along the lower mandibles and in front of the gill openings. If we speculate on the purpose of the pores, and the fluids they secrete, we are led to the conclusion that the mucous serves as some sort of protective lubricant.

But why would a fish want to

lubricate itself if it encounters only the resistance of sea water?

This question leads us to ask whether *Zaprora* actually does swim freely. Could it be that the high-brow is a highly-specialized fish that spends its life burrowing into the sea floor? It could, indeed, and, if that is so, the heavy coating of slime that *Zaprora* provides for itself is an excellent means of reducing the friction between its body and the semi-solid ooze at the bottom of the sea.

This guess as to its habits would seem to be substantiated by the protective covering provided for the eyes, which are situated high on the forehead, and the powerful pectoral fins, which are joined to the body at an angle that would make them best suited for downward movements. The covers for the gills are flexible and shaped in a manner that permits them to be open at the top while remaining closed below, thus enabling the gills to function like primitive snorkels.

One pictures *Zaprora* scuffling along, half buried in the ooze and sediment of the continental shelf. Its eyes remain above the mud to watch for trouble, while the scoop-like mouth roots about just below the surface in search of small crustaceans, tiny mollusks and other bottom-dwelling organisms. The powerful jaws and teeth may be shell crackers, and the heavy, blunt tongue may serve to expel the mud and broken shells from the mouth, while the morsels of food go down the gullet.

When danger threatens, *Zaprora* may dig in, thrusting itself downward with the contortions of its powerful, limber body and the beating of its pectoral fins—behaving like a marine mole.

The fact that *Zaprora selinus* seldom is caught in the drag seines and otter trawls of fishermen, who work the waters of the North Pacific Rim, does not necessarily mean that it is a marine rarity. It could mean that this digger of the deeps is provided with such an efficient means of protection that fish nets are the least of its worries.



Answers to "Nature Babies" Quiz.

1. Raccoon
2. Cottontail Rabbit.
3. Opossum.
4. Gray Squirrel.
5. Woodchuck.
6. Porcupine.
7. Screech Owl.
8. Magnolia Warblers.
9. Starling.
10. Nighthawk.
11. Red-eyed Vireos.
12. Phoebe.

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Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

Lines of Communication

REFERENCE TO OUR ACCUMULATED FILES shows that we have been very remiss in the matter of tissues and organs of the nervous system. It was back in the April issue for 1944 that we wrote an *Introduction to Neurons*, and the subject was not again broached until March, 1951, when the feature article was entitled *Information, Please!* and had to do with the many kinds of sensory nerve endings. Now we are constrained to deal further with that portion of the whole that connects the receptor of a stimulus and the central body to which the impulse passes.

Structurally there are two kinds of *nerve fibers*, those with an insulating sheath and those without one. This sheath is composed of a complex substance, *myelin*, principally lipoids with a lamination of rows of protein molecules. Fresh fibers are glistening white, as becomes their fatty nature, and many of the chemical reactions of myelin are those of fats: Alcohol will dissolve both myelin and fat and osmic acid blackens both. Because the appearance of these fiber sheaths reminded early workers of marrow, some chose the Greek name for that substance (*myelin*) and others the Latin (*medulla*); hence such fibers are distinguished as *myelinated* or *medullated*, whereas those lacking such a coating are *unmyelinated* or *nonmedullated*.

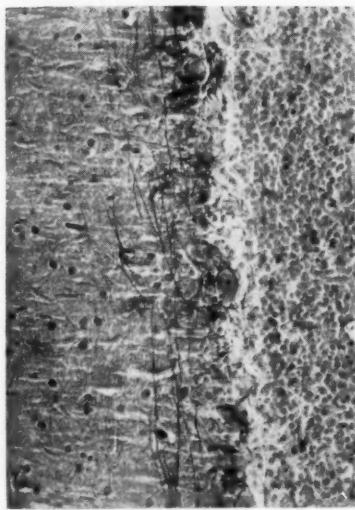
In development, all nerve fibers begin as unmyelinated continuations of the cytoplasm of nerve cells (neurons). In motor cells the dendrites, those short, numerous, and branching processes that carry impulses toward the cell body, are not considered as nerve fibers in the customary usage of the term and so such neurons have a single fiber, the *axon*, which grows out to the primordium of muscle or gland. As the body increases in size, so the fiber must grow in length, eventually, although microscopic in diameter, attaining a longitudinal dimension measured in

inches or feet, or even in yards in extreme cases. Thus a motor cell body located in the ventral horn of the spinal cord produces an axon that grows down the developing hind limb to a muscle in the foot, and if the animal in question happened to be a giraffe, or one of the great sauropod dinosaurs of former times, the length of the fiber is (or was) prodigious as compared with the diameter of its cell of origin—thousands of times the volume of the cell body.

The spinal cord

Adult voluntary neurons have multipolar cell bodies that lie in the gray matter of the central nervous system, the brain and spinal cord. As the axon grows outward it is unmyelinated for a short distance, but soon is encased in its insulating coating of myelin. Due to the fact that great numbers of fibers acquire their sheaths at approximately the same level, a cross-section of a fresh spinal cord shows a marked distinction between the regions preceding and following this addition. The inner zone, in the shape of a swallow-tail butterfly, or of the letter H, comprises the *gray matter* and looks grayish in hue because of its composition of naked protoplasm, the nerve cell bodies and unmyelinated fibers; the outer regions make up the *white matter*, with a milky appearance due to the preponderance of myelinated fibers and absence of cell bodies.

These fibers course in bundles that, within the central nervous system, are termed *tracts*, whereas outside, as components of the peripheral nervous system, the same bundles are designated *nerves*. A tract is a nerve encased within the brain or cord; a nerve is a bundle of fibers, usually including both myelinated and unmyelinated, together with a connective tissue framework and some blood vessels. Any given nerve may be purely sensory or wholly motor, or may be mixed. Tracts are pure and are referred to as ascending when



Unmyelinated nerve fibers in spinal cord of cat, 420X.

composed of sensory neuron fibers going toward the brain, and as descending if they are motor, running downward from the brain.

Sensory neurons have their cell bodies located in ganglia, outside the central nervous system, and have two processes. The long incoming one, from the skin or an organ of the body, is technically a dendrite, and the axon is generally much shorter since it runs only from the cell body into the nearby brain or cord. Both are myelinated in the voluntary apparatus, and both are called fibers. Many neurons that lie completely within the brain or cord, and are hence designated *intraneuronal* or *associational*, as well as one division of the autonomic neurons of the viscera, have solely unmyelinated fibers.

Upon leaving the brain or cord, each myelinated fiber acquires another coating, the *neurolemma*, or *sheath of Schwann*. This is a thin envelope made of ectodermal cells that wander out from the embryonic central nervous system and dispose themselves around the growing fibers. The cytoplasm of each Schwann cell becomes a very thin membrane, enclosing the fiber as in a tube; the nucleus is flat and oval, but, even so, causes a bulge in the fiber outline. Each Schwann cell covers a certain length of the whole fiber, up to 600 micra in the largest fibers, and then gives way to the next Schwann cell. At their junction they constrict the myelin sheath and form a *node of Ranvier*; the comparison has been made with a chain of link sausages. Each sausage is an *internode*, or seg-



Myelinated nerve fibers, teased, 420X.

ment, the casing is the neurolemma, and the place where one link is tied off from the next, restricting the meat (myelin), is a node. If an electric wire, composed of many fine wires, ran through the center of the whole chain of sausages, our mechanical model would be almost perfect. The neurolemma cell nucleus occurs at about the center of each internode. Should the fiber branch, sending off a collateral, it does so at a node.

Nervous impulses

The axon, when seen in a myelinated fiber, is termed the *axis cylinder*. It is perfectly continuous for the entire course of the fiber, running through the nodes of Ranvier. Its protoplasm is distinguished as *axoplasm*, is viscous in nature, and exhibits certain movements of its own. When fresh it appears homogeneous, but after fixation and staining with specific reagents much of it is seen to be differentiated as very fine fibers of a second order of smallness, hence called *fibrils*, and in this case *neurofibrils*, running lengthwise and undoubtedly associated with the rapid conduction of stimuli in the form of nervous *impulses*. Investigators have found that the impulse is propagated as a series of waves at a velocity that may attain the relatively enormous speed of 150 meters per second in the largest myelinated fibers, less rapid in smaller ones, and still slower in unmyelinated fibers. Passage of the impulse is accompanied by a change in electric potential, followed by a *refractory period* of brief duration when the fiber cannot be excited. A very

weak stimulus must build up to the threshold level of strength and, when this is reached, any stimulus strong enough to call forth a response will result in the maximum reaction of which the fiber is capable—the *all-or-none law*. In other words, above the threshold, a stronger stimulus does not elicit stronger reactions than a weak one, and the reason some responses are greater than others is that more neurons are involved.

Sections of brain and cord and ganglia are commonly stained with the usual hematoxylin and eosin combination for general features, but nervous tissue, more than any other, requires a host of special preparations in order to bring out all of its finer detail. The axis cylinder and its neurofibrils are best shown with one of the several varieties of silver nitrate technique, akin to the photographic process. The action of this reagent is impregnation rather than staining, for after treating with silver nitrate there is no staining effect; instead the impregnated fibers are exposed to light, breaking down the compound so as to deposit metallic silver in the fiber protoplasm. The fiber becomes yellow, then brown, and finally black; the longer the exposure, the darker the result, and best effects are secured through stopping the action by rinsing the preparation in water when the fibers are a rich brown. This performance does not affect the myelin, and hence medullated fibers remain more or less uncolored except at the nodes of Ranvier, where myelin is not present to protect the axis cylinder. Here the cylinder is browned for a short distance into each internode, and a transverse band, called the Q disc, cross plate, or cementing ring is seen, forming the horizontal element of *Ranvier's cross*. Some presume that this Q disc cements the two adjoining Schwann cells together, but its significance is conjectural.

Action of osmic acid

Quite opposite in action is osmic acid (osmium tetroxide), a costly and dangerous reagent. It is a celebrated fixer for chromosomes and is also used to blacken fat and myelin, but does not stain the axis cylinder. In cross sections of myelinated nerve fibers treated with silver nitrate, the axon is dark and the myelin colorless or, if alcohol was used anywhere in the technique, dissolved away; such a fiber gives the false impression of a cell with a stained nucleus, a

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notion that is quickly dispelled by focusing up and down and observing the rod-like appearance of the axis cylinder. If the sections are stained with osmic acid, the central space is clear and the periphery black—just the reverse picture. In longitudinal view under osmic acid the myelin shows oblique clefts, the *incisures of Schmidt-Lantermann*. These can be demonstrated in living, untreated fibers, and hence are not artifacts, but their meaning is not known. Special stains have also been developed to demonstrate the Schwann cells.

Individual myelinated nerve fibers may be teased out with fine needles from a nerve of a fresh-killed animal, such as the sciatic nerve of a frog, and processed as a whole mount. One of our illustrations shows several such fibers, one osmicated (treated with osmic acid) and exhibiting a node of Ranvier, another showing neurolemma and connective tissue nuclei. These preparations are not easy to photograph clearly since the fibers do not all lie in the same plane. In the other illustration a portion of a sectional view of the spinal cord is seen, with a number of large nerve cell bodies and many fine black unmyelinated nerve fibers.

Meteorological Optics

9. Halos

THESE are among the better known of a large series of atmospheric phenomena caused by reflection and refraction of light rays from the sun or moon by ice crystals in high cirrostratus clouds. Unlike the case of rainbows, the celestial body may be at any elevation. A halo may be white or prismatically colored; in the latter case it is red on the inside and white outside. Halos are the

gigantic circles or rings around the sun or moon, occurring in two forms, according to orientation of the ice crystals with reference to light source and observer, and such factors as gravity, winds, and turbulence of the upper atmosphere. The temperature of this type of cloud is always below freezing, water vapor

congealing to form minute ice crystals in various shapes, as plates and spicules, but invariably hexagonal. These crystals are hence prisms, differing from those we have discussed only in that, being frozen water, their refractive index is much lower than that of glass.

When light rays received by the

observer's eye pass through the 60° angles of these prisms at minimum deviation, a halo is seen of 22° angular radius, known as the *22-degree halo*; if, however, the rays pass through the 90° angles of these crystals, a much larger and fainter ring is seen, the *46-degree halo*. The 22° -degree halo is the more common and both are more frequent and brilliant in Arctic regions than elsewhere, and are more apt to be accompanied by various luminous arcs, crosses, bands, and other apparitions.

10. Parhelia

Among the almost numberless forms of similar phenomena occasionally seen, the *parhelic circle* is a luminous white horizontal circle resulting from regular reflection of light from the sun from sides and ends of ice crystals acting as vertical plane mirrors, and also by total internal reflection from within these prisms. A *parhelion* (beside-sun), called also *mock sun* or *sun dog*, is a moderate to brilliant luminous appearance, often tinged with color, occurring at any of the four points where the parhelic circle intersects the two halos. Those most often observed are the two lying on the 22° -degree halo, but sometimes all four occur. There are also *paraselenae* or *mock moons* or *moon dogs*.

11. Corona

Sometimes the term *corona* is applied to a halo, and may also refer to sun prominences in an entirely different meaning, but as used here describes a circle, usually colored, that may be seen around and close to the sun or moon. Its cause is very different from that of the true halo, being produced by diffraction and interference from droplets of water. There may be rain falling between the beholder and the sun, or the observation may be made through cloud, fog, or mist. The size of the corona is inversely proportional to that of the droplets; the smaller the drops the larger the corona. Thus it is possible for the drops to be large in one sector of view than in another, so that the corona would not form a perfect circle.

Commonly coronae display red, yellow, green, and blue zones, with the red on the outside, whereas halos, when colored, show red on the inside. In driving in a fog one sees miniature coronas around headlights of approaching cars.

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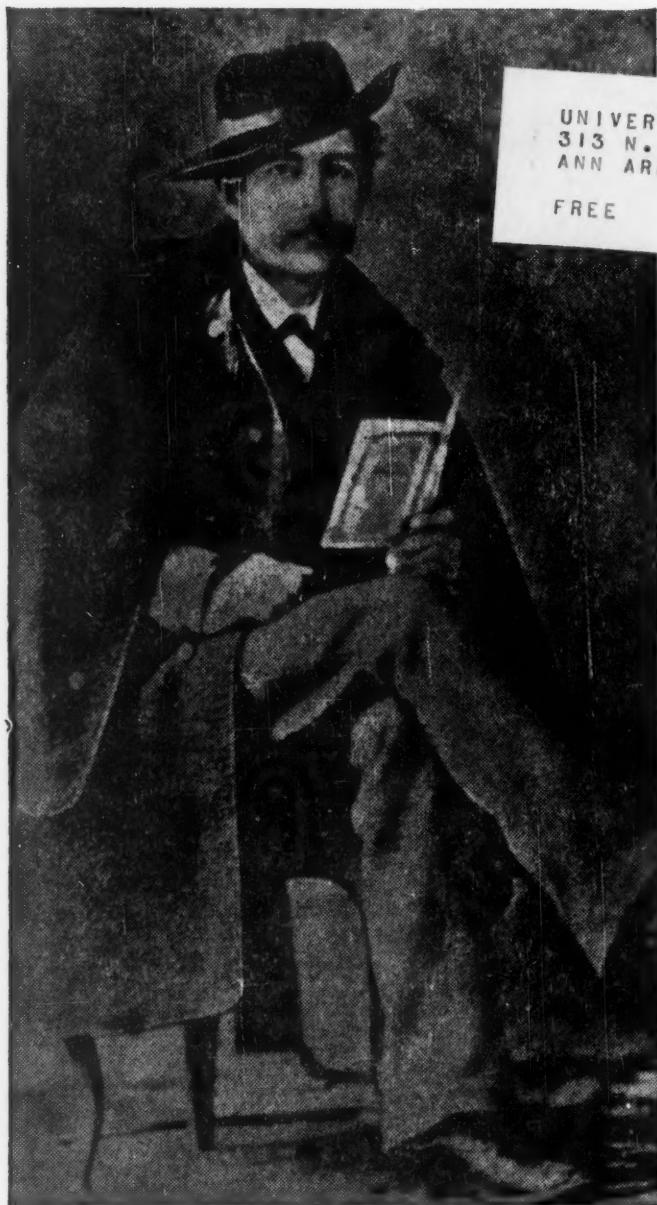
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